AMERICAN MACHINIST

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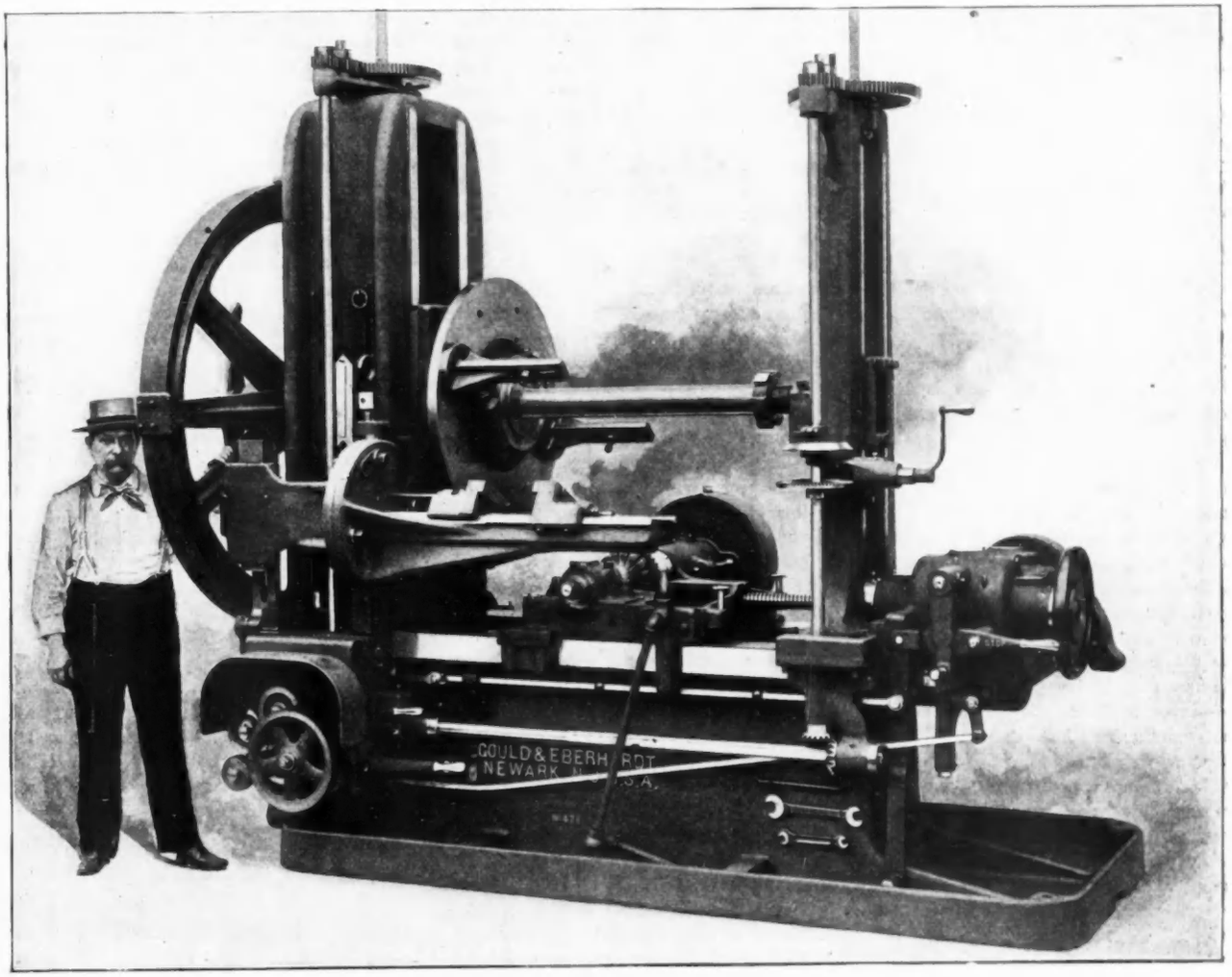
A Large Automatic Gear Cutter.

The gear cutter shown in the half tone will cut gears up to 100 inches diameter and 20 inches face, and to 4 inches circular pitch, or by means of a special attachment up to 6 inches pitch. That the machine has been built to the order of a prominent concern is only an evidence of the growing use of cut gearing in preference to castings, notwithstanding the improvements in the making of the latter.



LARGE AUTOMATIC GEAR CUTTER.

The machine takes standard gear cutters up to 12 inches diameter, with 3-inch hole. These large cutters as used in this machine are provided with a side locking cross key which renders their slipping on the arbor an impossibility. The cutter arbor has room enough for a blocking cutter and a finishing cutter for 4-inch pitch, so that one tooth is finished for each movement of the slide. The machine is driven by a single belt and the cutter speeds are changed by the substitution of change gears.

The automatic dividing and shifting mechanism is operated at a constant speed which is not affected by changes of the cutter speed. The cutter slide advances steadily under a heavy cut, and a quick and easy return occurs without jar or noise. The cutter arbor is worm driven, the worm running in a bath of oil. Spiral gearing, encased for automatic lubrication, is also generally used on the machine.

Wheels of any weight can be placed in the machine, by traveling crane or other means, without disturbing any set adjustments of the machine. A half clamp,

removable from the driving end of the arbor, allows it to rise vertically without interference. The outboard support of the wheel mandrel is raised and lowered by hand or power simultaneously with the main spindle; is can also be moved in or out for short or long mandrels. Two special drivers on the face plate hold the gear to be cut firmly in either direction, and a new automatic device clamps the rim of the wheel firmly while the cutter is operating. This clamp is automatically released at every shift, leaving the wheel free to turn. The dividing or master wheel in this machine is about 60 inches diameter, made in two sections, to secure accuracy. It can be instantly released from the worm, leaving the wheel which is to be cut free to be turned, so that it can easily be tried to see that it is true on the mandrel. The improved dividing mechanism is positive in its action, and the cutter slide cannot advance unless the indexing is correct. A simple pump of large size floods the cutters with oil and large pan capacity is provided so that the oil may cool. It is expected that this machine will cut in one day a gear 84 inches diameter and 12-inch face. The weight of the machine is about eight tons. It is built by Gould & Eberhardt, Newark, N. J.

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The Place of our Destination—IX.

ANTWERP—MEASURING MACHINES—PIT PLANERS.

Editor American Machinist:

From Brussels to Antwerp is but a short ride, and Antwerp, figuratively speaking, is a city with two centers—the cathedral and Rubens. Who has ever heard of Antwerp without hearing of its wonderful cathedral, with its tall, open-work stone spire, and no one who has been through the cathedral can ever forget the many sights and the carved-oak pulpit, 150 years old or so, and no one can go to Antwerp and come away without a realizing sense of what a great man's influence may be for years on the city of his birth. Rubens was much besides a great painter, and he was a great painter in two ways. Those able to judge of art considered him one of the masters, and the mechanic who goes by yards and acres and finds the numberless mammoth canvasses scattered all over Europe, cannot but wonder if any house painter ever covered so much surface with plain white paint—much more, how one artist could paint so many pictures. And when a man can do such work that for a century after a whole city seems to revolve around his name and glory in it, that certainly is a great achievement.

When I was an apprentice boy in an architect's office, the story of an open-work stone spire, three hundred odd feet high that had stood for hundreds of years, seemed a pretty tall story, as well as a very tall spire; and now after forty-five years or so, and after seeing the wonders of the world, the open-work spire still stands here, defying the storms of the sea and the ravages of time, and as hard a story to believe now as then.

Then, too, as many years ago we read the story of the iron well, the work of a smith who wanted to marry an artist's daughter, and did this work to show that he, too, was an artist. No matter about the story, but the well still stands.

In front of the cathedral and with a stone curb, is a well which is covered by an iron well-house or canopy, a work of art and entirely hand work in iron; not delicate in the way of the fine work at the Brussels exhibition, but clustered Gothic columns, perhaps 2 inches in diameter altogether, with bases, beads and capitals.

The columns look, a little way off, like such rolling-mill work as we might buy, stick in the sand and cast on bases and caps, but on inspection prove to be swaged and chipped and filed from solid wrought iron, with arches springing from column to column and across, with much delicate scroll and flower work forming the resemblance of a roof. This, too, has been one of the sights of Antwerp for centuries. The history of Antwerp is interesting. In 1500 it was one of the largest commercial cities on the Continent, held a thousand ships in its harbor, and a hundred arrived and departed every day. Wars and treaties shut out its commerce, and in the middle of the seventeenth century it had dwindled to 40,000 inhabitants. Now it is again a seaport town of 200,000 people and of much interest.

From Brussels every visitor has to go to the battlefield of Waterloo, twelve or fifteen miles away. The lion mound, built of bricks and earth, covering 5½ acres at its base and sloping up to 200 feet high, gives, from its top, an outlook from which one can see the whole battlefield as on a map. It is strange and lamentable that every bit of history has to have war mixed up with it some way—and what is worse, there is so little prospect that it will ever end—a nation claiming to be the most advanced of any in the world, with eight-tenths of its people clamoring for peace arbitration; nine-tenths voting millions for guns and ships of war, and ten-tenths ready to go to war over the Venezuela boundary, which was none of our business; with Japan over Hawaii, or for a few fish up in the Behring Sea—arbitration with a gun.

During a couple of visits to Ghent, I was much interested in many things seen at the works of Van Der Kerscham and the Phoenix; but fearing I may be going over ground you have already covered, I will only remark that I could not see why they were not able to make anything they wanted to, and as good as any one. It is more a question of what they want than of ability to make it. The two-meter measuring machine, built in Manchester for Van Der Kerscham, compounded for inches or millimeters, I was interested in, but do not believe in. It is rigged with magnetic contact with which one can read down to the 50,000 perhaps; but he must trust to notches in the bed to locate the tail stock, which a little dust would upset to ten times the amount. I do not believe that anything but a set of standards, with an adjustable zero to set the machine by at the time it is used, is reliable for measurements of any great length; besides, the long screws in short nuts are bound to wear out of pitch if used much; particularly so with a V-thread, because a change of diameter means additional change in pitch.

The pit planing machine, mentioned in a former letter, seems to be a common machine in the large shops, and must possess merit, or it would not be used. And I think there is a good reason why it is not used with us. It takes too long to set the work—a matter of very much less importance with low than with high wages. To utilize these machines, or to fit the idea to our advantage, I believe the entire bottom of the pit should be a cast-iron table like other planer beds, with screws or hydraulic elevators to lift it to any required position, with corner angles and dowel-pin holes accurately spaced, say 6 inches apart, so that the bed will be held perfectly level in whatever position set. This would enable the operator to set work exactly as on any planing machine.

One fundamental objection to the machine is, the wearing out of truth by the short slides on the long ways; and to get over this, abandon the planing principle entirely, and put on a head with a revolving vertical spindle, driven by mechanism powerful enough to do work, and with a vertical feed to the spindle. Now see what the machine would do—dress flat surfaces as well as the planing machine; cut all shapes, such as dovetails, with properly formed cutters; make all cross-cuts, as well as longitudinal ones; bore holes; drill and tap, and all at one setting of the piece; besides, the ways would remain true as many years as the present machine can weeks. The table, when brought up level with the floor, would floor over the pit.

JOHN E. SWEET.

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The National Tube Works Co., at McKeesport, Pa., has announced that wages will be advanced 10 per cent. in all departments of its mills on August 30th. The increase will affect between four thousand and five thousand employés.

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Gallium is quoted at $3,000 per ounce; germanium, $1,125 per ounce; rhodium, $112 per ounce; ruthenium, $90; iridium, $37; osmium, $26; palladium, $24, and cast iron $0.000375 per ounce.

A Rear-Fork End—How to Make It.

To make the rear-fork end, shown in sketches 2 and 3, we first make the blank, Fig. 1, of a good quality of dead soft steel.

It will hardly be necessary to give a detailed description of the blanking die, which can be made of one piece, but preferably of three pieces. The forming dies Figs. 7 and 8 are designed to be made with the least possible work. Fig. 7 shows plan and end view of the male die. The recesses for holding the pins, which form the ferrules, are made with cutters turned to the same templet as the forming pins. These pins are secured by riveting after being hardened. The central rib is simply fitted to drive into place after being hardened. The grooves at either side of each pin register with the ribs on the female die. This enables us to form the full half-round on the ferrule and obviates trimming the ferrule. The construction of the female die is shown in Fig. 8. The four gage pins shown on the female die register with holes in the male die. To make the ¾ x ⅞ inch fork end shown, of course necessitates two sets of these forming dies. After forming the piece is trimmed in the die Figs. 4 and 5. This die being the most expensive of the whole outfit, it was desirable that it have as much range as possible. The die as shown trims the piece to the shoulder, thus allowing fork-ends of any angle in use to be trimmed in the same die. In trimming the ¾ x ⅞ inch pieces, it is only necessary to have the piece *B* shaped as shown and to have two punches, one flat and the other concaved to fit the convex side of the piece, half of the pieces being punched with the convex side up and the others with the concave side up. The two knock-outs must be made to fit the stamped piece accurately, as the gaging is done by them. The pins *E*, *E*, *E*, *E*, operate the knock-out. *F*, *F*, *F*, *F* are the punches for punching the rivet holes. We found that the punching one-half each way in the same die had the further advantage of insuring the perfect register of the rivet holes. I should advise it even when both tubes are the same size. Of course theoretically there should be no difficulty in punching them all one way, but I think my practical friends will agree with me in saying, that it is best not to risk anything to accurate workmanship when there is a sure way. After trimming the halves are riveted together in the die Figs. 10 and 11. The lower die Fig. 11, consists of the block *A*, into which the lower punches are riveted. *B* is a clamping block backed by the rubber spring *F*, Fig. 10; *D* is a gage plate, fitting the fork end, and secured to *B* with screws.

The upper punches are practically the same as the lower, omitting the gage plate and securing the clamping block *C* with two screws as shown by dotted lines *H*. If care is taken to cut the rivets to accurate length they will rivet flush and leave no sign of themselves. The rivet holes should be countersunk just a trifle. This is very handily and speedily done with a countersink in a speed lathe, holding the piece in the hand. Fig. 9 shows front and side elevation of die for closing and setting the females after riveting. The mandrels are set so that the round end bottoming forms the gage. The hardening embodies no especial features that have not been mentioned in previous articles. The face of the forming dies can best be hardened with a stream of water directly applied or coming up from the bottom of the quenching tub.

The fluted nuts can be blanked out round and milled or fluted in a die at another operation. This type of fork-end can, equally well, be adapted to tubing of either *D* or oval section.

W. A. WARMAN.

Buffalo, N. Y.

Fig. 1

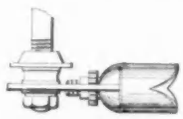

Fig. 2

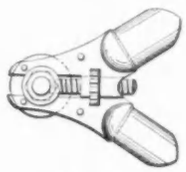

Fig. 3

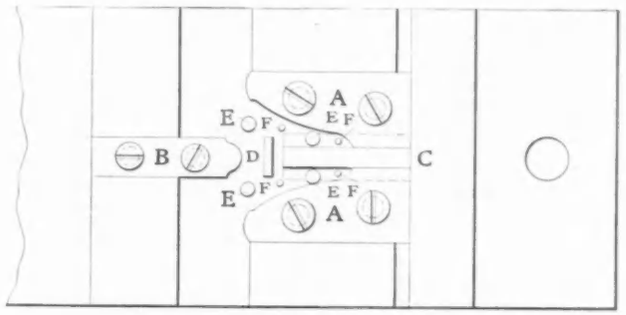

Fig. 4

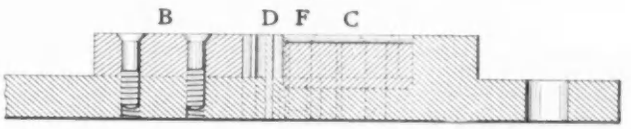

Fig. 5

Fig. 6

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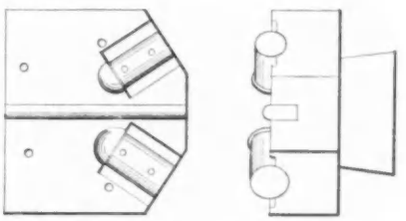

Fig. 7

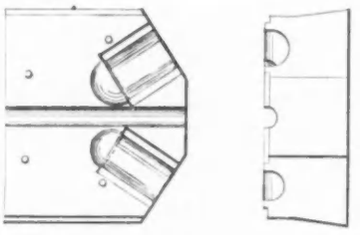

Fig. 8

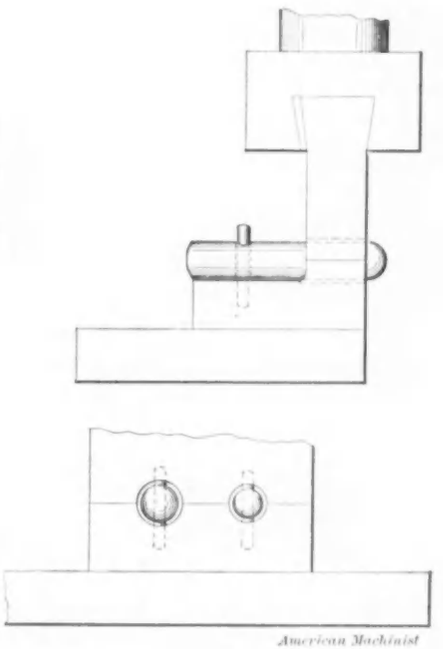

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Fig. 9

DIES FOR SHAPING FORK-ENDS.

Comparative Friction of Chains and Gears on Bicycles.

Professor R. C. Carpenter, of Cornell University, who has been conducting an elaborate series of experiments on bicycle friction, discourses on the subject as follows:

"Our investigations are not entirely completed at the present time, but it seems safe to announce that all of the tests indicate that no form of gearing can possibly equal the best chain for efficiency and durability. Some of the results of the tests may be interesting, and it may be briefly stated that the friction with the best chain varied from one-half to three-quarters of one per cent., and this result was obtained with a chain which had been in use on a wheel that had been ridden for more than 2,000 miles by a rider weighing nearly 200 pounds. This would serve to show that high-grade chains can be and are made which do not change their form by wear an amount sufficient to affect the friction. Tests were made on a large number of other chains, and the friction was found to vary from two to five per cent., depending upon the condition of the chain, the method of construction and details of the design. The highest friction we have found, even in the case of an old chain, which did not fit the sprocket properly, did not exceed ten per cent., although I am willing to concede that a considerably higher friction might in some instances be found.

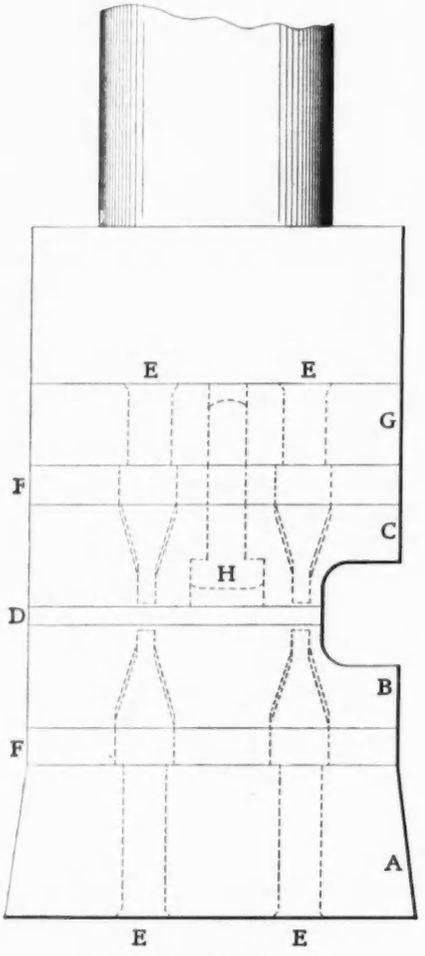

Fig. 10

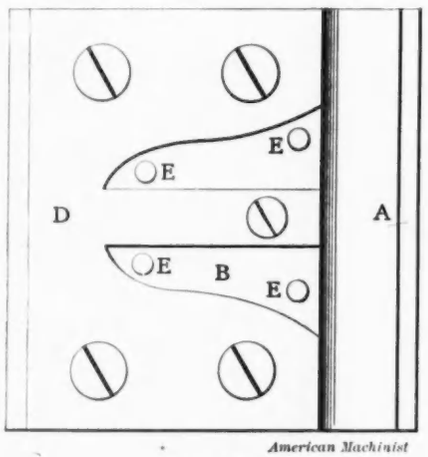

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Fig. 11

DIES FOR FORK-END.

"Regarding the use of gears, extensive investigations have been made from time to time which show the amount of power lost in friction. The very best recorded results with spur gearing are very nearly equal to those obtained with the ordinary chain when the gearing is in the best condition and working accurately in line and position. The best kind of bevel or spiral gears, a form which must be used in bicycle work, show about three times the friction of the spur gears, and since two pairs must be used on each bicycle, about four times as much friction as the ordinary chain will be developed, and six to eight times the friction of the very best chains.

"There is another serious objection to the use of gears arising from the facts that the least change in position of the point of contact of the gear from its normal will cause a great increase in friction and in loss of power over that stated in the preceding discussion. This indicates that the gearing is essentially unfitted for a frame which must from the very nature of its use possess great elasticity and flexibility.

"In our investigation the friction of several bicycles running under ordinary conditions was measured. This for the very best wheels under heavy working condition was found to be from five to eight per cent. of the power supplied, while with some of the poorer wheels the friction was twenty to forty per cent.

"One of the noted manufacturers of high-grade wheels kindly permitted an opportunity of comparing a chainless wheel, which was constructed in the most approved manner, and with the friction reduced to the smallest possible amount, with the same kind of wheel equipped with the best chain."

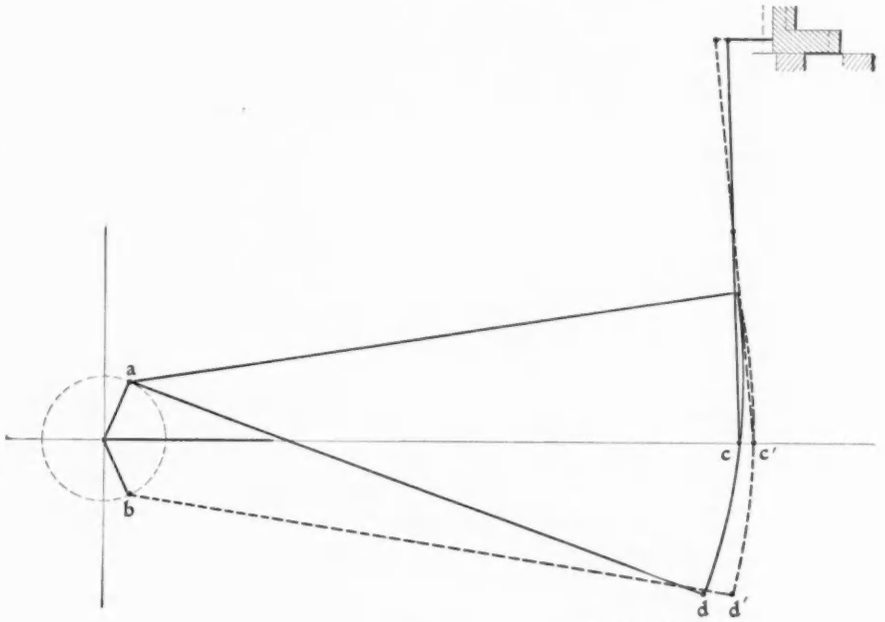

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Fig. 5

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The Locomotive Link Motion—II.

BY F. A. HALSEY.

THE SHIFTING LINK GIVES VARIABLE LEAD.

With the shifting link motion the link itself is raised or lowered to reverse the engine or shorten the cut-off. The nature of the movement of the valve is not thereby materially changed although an important difference is introduced in making the lead variable. The reason for this variation in the lead can be seen from Fig. 5, which represents the shifting link as commonly applied to American locomotives. The crank is shown upon the forward center, for which position of the crank the forward eccentric is at *a* and the backing eccentric at *b*, the forward

eccentric rod being shown by a full line and the backing rod by a dotted line. In this position of the crank the valve has opened the port by the amount of the mid-gear lead. If now the backing eccentric be moved so that its center coincides with that of the forward eccentric at *a*, and the link be dropped to the full gear position, the valve will take the full gear lead, and if the link arc has been struck from *a* as a center, the link may be swung throughout its range without disturbing this full gear lead. If now the center of the backing eccentric be brought back to its true position at *b*, the lower end of the link will be swung from *d* to *d'* the link block will be pushed to the right from *c* to *c'* and the valve will be drawn to the left, thereby increasing the lead for the mid-gear. In other words, the full line valve sketch shows the full gear lead, while the dotted position shows the mid-gear lead.

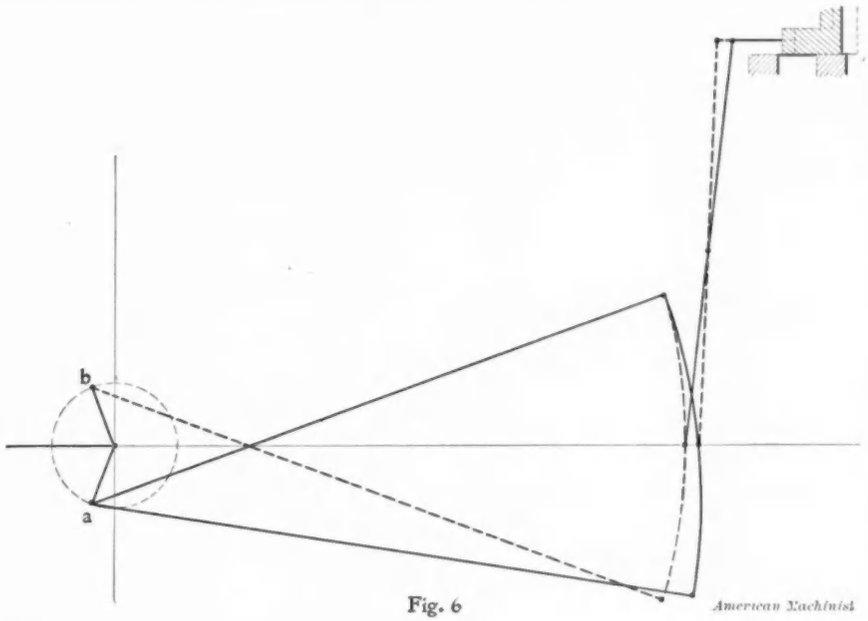

Fig. 6

Fig. 6 shows the same arrangement ment with the crank turned to the back center, the forward eccentric now occupying the position *a* and the backing eccentric the position *b*. It is evident as before that with the backing eccentric moved to coincide with the forward eccentric at *a*, the link may be raised or lowered throughout its range without affecting the lead, but that replacing the backing eccentric to its true position, *b* will draw the lower end of the link to the left and increase the mid-gear lead as before. The proportions of these diagrams are purposely so chosen as to exaggerate this action. In actual full sized locomotives having, say, 1-16 inch lead in the full gear, the lead in the mid-gear is increased to from ¼ to ⅜ inch.

THE CORRECT RADIUS OF THE LINK.

Figs. 5 and 6 also serve to show that the proper radius of the link is the length of the eccentric rod, plus such distance as there may be between the link arc and the eccentric rod pin.*

If the link were struck with a smaller radius using the same length of rods the effect would be an increase in the mid gear lead in Fig. 5, but a decrease in Fig. 6, while if it were struck with a larger radius the effect would be to decrease it in Fig. 5, but to increase it in Fig. 6; that is the effect of using any other radius than the one shown would be to make the mid gear lead unequal for the two ends of the cylinder. It has been repeatedly suggested that the link could be curved in such a way as to compensate for the action of the rods in making the mid gear lead greater than that for the full gear, and while it would of course be possible to find a curve for the link of very large radius such that the link block *c*, of Fig. 5 should not change its position for the forward center as the link is raised or lowered, this would only produce a still larger mid gear lead for the back center as shown in Fig. 6. In other words, a link so arranged as to produce a constant lead for all grades of expansion at one end of the cylinder would be at the expense of a still greater variation for the other end of the cylinder.

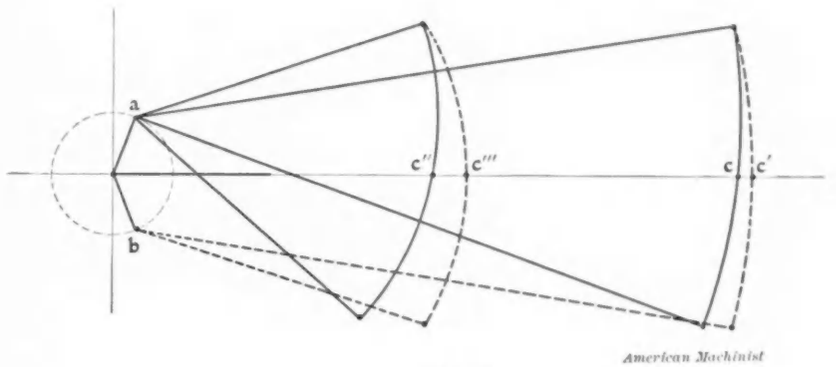

Fig. 7

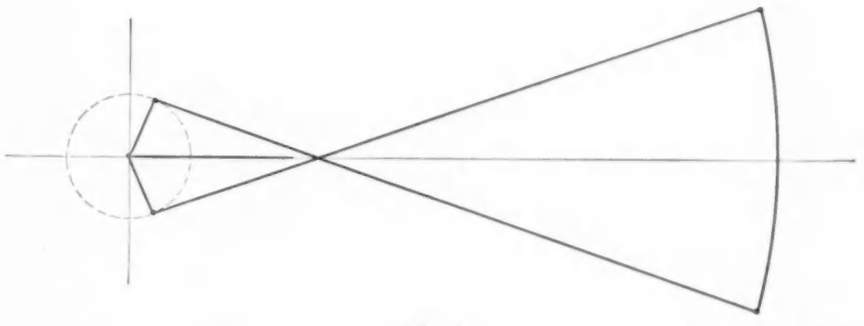

Fig. 8 American Machinist

LONG AND SHORT ECCENTRIC RODS.

The effect of shortening the eccentric rods is to increase the difference between the full and mid gear leads as will be seen by Fig. 7, which shows the same construction as that of Fig. 5, but drawn for two lengths of rods. It will be seen at once that the distance between *c''* and *c'''* is much greater than that between *c* and *c.'* This increase in the mid gear lead with short rods accounts for the strong effort always made to use long eccentric rods, which in the case of consolidation and ten wheeled engines has been carried so far as to carry the rods over the forward driving axle at the expense of making them crooked. The spring of crooked rods is, however, so great as to lead to a defective valve action as has already been shown in Mr. Herr's cards given in Fig. 2, and the Schenectady Locomotive Works now make the eccentric rods in these engines much shorter, the rock shaft being placed between the forward and the next following driver,

* None here shown

instead of forward of the forward driver. This is done because experience shows the evils due to the increased mid gear lead of short eccentric rods, to be less than those due to the spring of crooked rods.

OPEN AND CROSSED RODS.

A link motion arranged as shown in Figs. 5 and 6, is said to have open rods, whereas with the rods arranged as in Fig. 8 they are said to be crossed. These rods will be seen also to be crossed in Fig. 6, so that the term is not altogether fortunate. It is to be understood, however, that by the term open rods, as describing a link motion, is meant that the rods are uncrossed when the eccentric centers lie between the link and the vertical center line of the shaft, or, in other words, that the forward eccentric connects with the upper end of the link. By diagrams similar to Figs. 5 and 6 it could be shown that the effect of crossed rods is to give a decreasing lead as the cut-off is shortened. Crossed rods are not, however, in actual use, and a detailed discussion of them seems uncalled for.

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On the Construction of Armature Cores.

BY WM. BAXTER, JR.

An armature core should be so rigid that it will not suffer distortion, no matter how roughly it may be handled, and the insulation between the laminations should be so perfect that the effect of vibrations and of expansion and contraction due to changes in temperature will not cause it to deteriorate. To attain this degree of perfection it is necessary that every detail of construction, from beginning to end, receive proper attention. The insulation of the sheet iron disks has always been a rather troublesome matter, and there is quite a difference of opinion as to the best course to pursue, not only to reduce the labor, but to insure the best results. Some builders believe that the easiest and surest way, is to cut the paper and iron blanks separately, and place them in position alternately when the core is built up; others believe that better results can be obtained by pasting the paper on the iron before the blanks are cut out, as by so doing only half as many pieces have to be handled in building up the core, and as they are all sheet iron they can be treated rather roughly without any fear of their being doubled up or torn. In constructing smooth cores of small size, and specially of the drum type, the first method may be made as effective and economical as the second, but with grooved cores it is difficult to see how it can be applied with success. If the blanks are round washers, there can be very little difficulty in providing mechanism that will place them in position upon the hub in alternate order and in proper position, but if they have projecting teeth, the operation becomes more difficult, as in addition to placing the blank central it must be shifted around the circle so as to bring the teeth in line. With cores of large size, the flimsiness

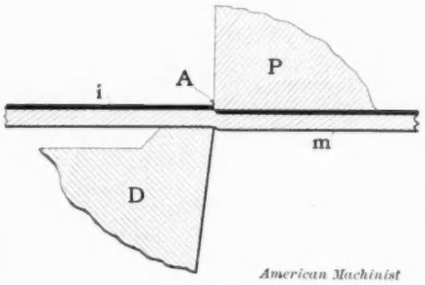

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

of the paper would prove a source of great annoyance and would render the use of separate paper blanks inadvisable, even with smooth cores, and totally impractical with those of the grooved type.

When the paper is pasted on the iron before the blanks are cut, the proper course to pursue is to apply it to the whole sheet so that when these are cut into strips, out of which to punch the blanks, these strips will be covered on one side with paper, and it will be trimmed even with the iron along the edges. If the core is to be built up of segments, these will have to be arranged so that between two layers the iron sides come in contact, and between the next two layers the paper sides adjoin. On this account, when segments are punched, the paper should be half the thickness required for the insulation.

Although pasting paper on sheet iron is apparently so simple a matter that any apprentice boy can do it, the great majority of people find it difficult to do in a satisfactory manner at first. Not only does the paper fail to stick to all parts of the surface of the iron, but it also persists in gathering up in wrinkles. The failure to adhere to the entire surface is not a serious matter, providing it sticks enough to not fall off the blanks before they are put in place, but the wrinkles are an almost fatal defect, as they give the sheet increased thickness at the points where they occur, and thus render it impossible to draw the remainder of the surface to a solid bearing, when the core is pressed up, unless an enormous pressure is used. To apply the paper without wrinkles it is necessary to use paper that is very firm so that it will not stretch much when moistened; the paste should be very stiff, and should be applied to the iron and not to the paper. A large brush should be used, and it must be stiff enough to spread the thick paste in a thin layer, and do it quickly, before it has time to dry. The paper should then be pressed down with a hard brush, such as a shoe brush. To do this work in a satisfactory manner all that is necessary is to provide a bench large enough to hold a whole sheet of iron, and to mount at one end of it a stand to hold a roll of paper about two inches wider than the iron. The paste is applied evenly and quickly to the iron, the paper is pulled out over it and pressed down with a brush rubbing from the center to the sides. The paper is made wider than the iron, so that no time may be lost in matching it along the edges. A rack should be provided that will hold the sheets of iron edgewise, so that they may dry quickly, and also so that they may not rub against each other while wet and tear the paper. By following the above process, the paper can be applied perfectly smooth after a very little practice.

Those who believe that punching out the blanks separately is the best plan base their objection to pasting the paper on the iron on the assumption that by so doing the blanks are more liable to have burrs along the edges, but this objection does not hold good if the blanks are cut with the iron side up. That this is true can be seen from Fig. 1, which represents a section through the cutting edge of a punch and die, the sheet iron being magnified several times to illustrate the action more clearly. When the punch begins to

press the sheet down upon the die, the paper *i* being soft, will be compressed at the point where the cutting edge impinges as shown at *A*. The sheet iron *m* will be bent down in a curve from the edge and will not begin to shear until the paper has been forced out of place at the point *A* and the punch *P* comes directly in contact with it, or nearly so. This will be the effect providing the punch is sharp, and the edge of the blank will be about as shown in Fig. 2, exaggerated of course. If the punch is not sharp, the edge will be as in Fig. 3. If the sheet iron is inverted, so that the paper is on the under side, the blank cut with a sharp punch will be as in Fig. 4, and with a dull punch, as in Fig. 5.

The burrs on the blanks may be smoothed down by means of rollers, but if this process is resorted to with blank Fig. 3, cut paper side up, with a dull punch, the effect will be as shown in Fig. 6, where it will be seen that the iron is flattened down to the level of the paper only. If blank Fig. 5 is passed through the rollers, the effect will be as shown in Fig. 7. When the blanks are punched with the paper side up the scrap has the smoothest edge, and the blank the roughest, which is just the reverse of what is wanted. When the iron side is up the man operating the press can detect the burrs as soon as the punch gets dull, but with the paper side up they cannot be noticed until they become very large. If the blanks are cut with dull or imperfectly fitting dies, it will be found difficult to press the core up tight without bulging out the surfaces, as shown in Fig. 8, which represents a section through an armature core, parallel with the shaft, and in one of the spaces between the teeth. This effect will be specially noticeable if the core is thin and has a wide face, and still more so if in addition the rivets do not fit closely in the holes.

It is not difficult to see why the burrs should cause the core to spring outward, it is simply because the length of the edges of the teeth *T* is much greater than that of the inner side of the core, therefore, when the pressure is applied, the inside burrs flatten out more than those around the teeth. This alone will show the importance of having the blanks clean cut; it will also show how necessary it is that the rivets should fit the holes perfectly. If the teeth are very long, in comparison with the thickness of the rim of the core, as they are shown in Fig. 8, by dimensions *B* and *C*, the tendency to bow out will be much greater than if they are short. The trouble can be overcome in part, by making the rings that fit in the spaces *A* when the core is pressed up (see Fig. 4 of article in No. II. of "American Machinist") thicker on the outer diameter, so as to produce a greater pressure at this point and thus flatten out the burrs around the teeth to a greater extent. By using a clamping ring, such as shown in Fig. 9 the defect can be still further prevented. As the core, even under the best conditions will not come out perfectly true, the clamp cannot be made of the exact diameter that the core should be, but the allowance over this size should not be more than two or three hundredths of an inch. This clamp must be bored out true, and made with a rib, as shown in the section *A* so that it will not spring out of shape. The best way to prevent the bowing out effect, it may hardly be necessary to state, is to keep the dies in proper order, so that the blanks may be free from burrs, but even when this is done, if the core is wide enough and the teeth are very long, it cannot be kept from spreading. With the proportion of thickness of rim to hight of teeth and width of face used in the great majority of armature cores, there need be no difficulty so far as bowing out is concerned, providing the rivets will fit and the blanks are clean cut. Whenever difficulty occurs, it can be surmounted by the use of the ring clamp Fig. 9 and the use of rings with extra thick outer edge in the spaces *A*.

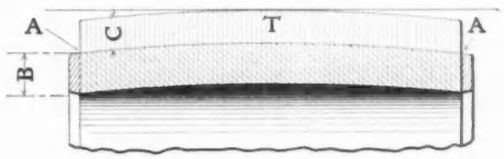

Fig. 8

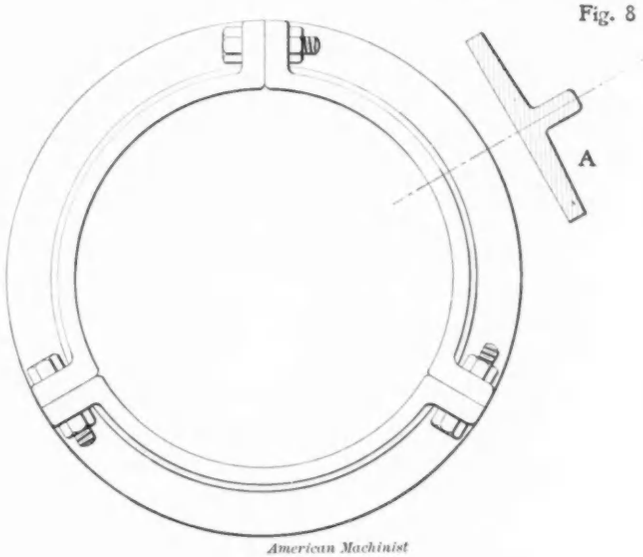

Fig. 9

If the dies with which the blanks are cut, and those with which the holes are punched, and the form upon which the core is built up are made as accurate as possible, the core will come out very nearly true, but not sufficiently so to answer without being turned off on the outer surface. If these tools are not as accurate as they might be, the grooves, as well as the outer surface, will require dressing. The outer surface may be trued off in a lathe, but it will be found cheaper and better to grind it off with emery wheels. If a tool is used it will chatter badly, unless the grooves are filled up with wood, but this expedient is not necessary when grinding is resorted to. The grooves may be trued up either with a file, an emery wheel, a sharp tool in a shaper or a sharp cutter in a milling machine. The last two methods are the poorest, as they will bend over the teeth at the finishing end, unless very substantial means are provided to prevent it. The grinding process is the best of all, providing you have the proper appliances for doing it; next to this comes filing. Whatever process may be used, for either part of the truing up, it is necessary to avoid the formation of burrs that will lap from one layer of segments to that adjoining it. This defect is illustrated in Fig.

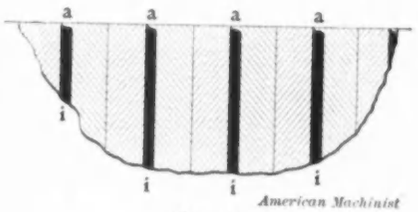

Fig. 10

10, which represents a portion of the surface of a core, largely magnified so as to show the burrs more clearly. The harder the paper insulation *i*, the smaller the burrs *a* will be, under the same conditions, therefore, every effort should be made to make the paper as hard as possible. This may be accomplished in two ways, one by pressing up the core as tight as possible, and the other by saturating the

paper with shellac varnish. As good a way as any, to apply the varnish, is to rub it on the surface of the core, just before it is pressed up; but this process has the objection that it soon covers the form with varnish, and unless this is thoroughly removed, it becomes a source of considerable annoyance. Another process, which avoids the foregoing objections, is to varnish the edges of each blank separately. Although this is a tedious process, it can be done by boys, and at a slight expense. The burrs can be still further reduced, by taking the finishing cut with a fine cutting tool, whatever its kind may be. If the outer surface is trued up in a lathe, put a keen edge on the tool for the last cut, and make this cut just enough to remove the burr. If emery wheels are used, finish up with a very fine wheel, and if a file is used, finish off with a fine file.

It is best to avoid truing up the grooves, if possible, as in these any kind of tool used will cut across the joints, and therefore be more likely to carry burrs over. If the grooves are made one or two hundredths of an inch wider and deeper than necessary, and the dies and other tools are sufficiently accurate, truing up can be dispensed with.

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The Mission of Foundry Facings.

In the paper presented by H. F. Frohman, before the Western Foundrymen's Association, on "Foundry Facings," there appear several statements which are at least open for discussion.

We are told that "sea coal is mixed with the sand to vent the mold and allow the gases to escape." When we consider that sea coal or ground bituminous coal is a great gas-producing material, as anyone can prove to his own satisfaction by throwing a handful of it on the top of a ladle of iron or an open sand plate, just after it is cast, and when we further consider that facing sand is only used for an inch or two in immediate proximity to the pattern, while the greatest part of the mold is made up of heap sand, it becomes rather difficult to see by what method the sea coal, in an inch or two of sand next to the casting, is going to provide an egress for the gases generated, through the rest of the mold.

Instead of helping to vent a mold, sea coal actually renders extra venting necessary. We know that the molding sand itself will produce a certain amount of gas, and if we now place an extra amount of gas producing material, such as sea coal, therein, does it not appear reasonable that more gas must be made than formerly, and that consequently we are compelled to provide increased facilities for its outlet? The author himself states that coal, suitable for the best facing, is high in hydro-carbon gases and volatile matter, and it would be interesting to know how this material is going to provide an egress through a large body of sand with which it does not come in contact.

The statement that sea coal is necessary to produce "a good and sound casting" is contradicted in all classes of foundries. Sea coal, like blacking or plumbago, is not used because it adds to the soundness of a casting; if it did, facing mills would be a great deal busier than they are. It is used simply to save labor in cleaning the casting, and nothing else. If a mold is not prepared right, and shows a tendency to scab or cut, all the facing that can be put in the sand or on the surface of the mold is not going to prevent this. If a casting is heavy enough to fuse the sand, it will still be found that not a particle of this has entered the metal. In fact it is an old saying, that the roughest casting generally turns up cleanest. Foundries producing light work seldom use facing in any form, and the perfection of their castings, after they have passed through the tumbling barrel, is sufficient proof that sound castings can be made just as well without facing as with it. Not only are light castings equally well made without facing, but heavy castings made in loam or dry sand will prove sound and clean if molded without facing. I know some foundries have the habit of mixing one part of facing to fifty parts of sand for this kind of work, but the adding of this insignificant amount is merely from force of habit. Blacking alone, on such molds, is what peels the casting.

The author states that "a facing or blacking is also needed to a certain extent to pave the way so that the molten metal will have an easy glide and at the same time overcome as much resistance as possible and not in any way retard the flow, but on the contrary help it along to find its proper resting place." While facing and some kinds of blacking never appeared very smooth to the writer, it is true that plumbago is a great lubricant and makes nearly everything run easier, but this does not hold good in molding; it makes a mold "slick," but this way of greasing a mold does not in any manner aid the iron in running over it. On the contrary, facing and blacking or plumbago of all kinds positively retard the flow of the iron instead of helping it along.

Whenever we see a casting cold shut or possibly a small hole, where the iron has lost its fluidity and failed to unite, we may at first glance say that the iron was not hot enough, but every practical foundry foreman knows that facing and blacking are generally to blame for such defects. They disappear altogether when common heap sand is substituted on that part of the mold where the defects occur. About the most difficult job a foreman can have to look after, is to keep the molders from using facing sand or blacking where they should not. Not only light castings and light parts of castings, but even heavy gears will have their teeth badly cold shut, unless exceptional care is exercised in the selection of a proper facing sand. The same holds good with plates of all descriptions. Facing sand will mar the edges with ungainly marks, and even the bottom, which in most cases is covered very rapidly, will show the same defect.

Besides the tendency of facing to retard the flow of the iron and thus cause cold shuts, it also shows an inclination, especially in light work, to give the casting a hard skin. Perhaps the best example of this can be found in pulleys with light rims. Most foremen insist that no facing shall be used on these outside of the hubs and arms. This is not done for the sake of economy in the foundry, because the casting cleaner will spend a good deal more time cleaning such a casting, than the facing is worth. The saving effected by not using facing does not show itself until the machine shop is reached. To have the machinist wear a broad smile and allow him to take a wide cut, without dulling his tools on a hard skin and hard spots, it has been my experience that nothing equals leaving the facing in the barrel.

The temperature of the metal and the extent of the body thereof are not the only conditions to be considered in applying a coat of facing or blacking to the mold. The hydrostatic pressure exerted by the fluid mass must also be taken into account. For instance if we cast a ring of equal thickness, say thirty inches deep, the top part of this casting will peel comparatively easy if molded in common heap sand, while the bottom part of the mold will adhere tenaciously to the casting, even where a facing sand of considerable strength is employed. You may say that this is caused by a higher temperature in the lower part, but you can convince yourself that this is not so by pouring the metal entirely from the top, when the hottest metal is in the uppermost portion. The result will be the same. A heavy casting made in green sand shows itself to have been made by a good molder when it peels even throughout, and there are but few who have given the subject enough attention to have their castings come out thus.

A suitable molding sand will largely do away with the necessity for facing. Some foundries are compelled to spend a considerable amount of money yearly for sea coal facing, which they could avoid by purchasing a better sand. Some shops are using facing sand consisting of one seventh sea coal, where others on the same class of work are getting better results with heap sand. It all depends on where the shop calculates to make the saving. The mission of all foundry facings or blackings is simply to peel the casting and nothing more. They can neither improve the soundness of the casting nor the quality of the mold,

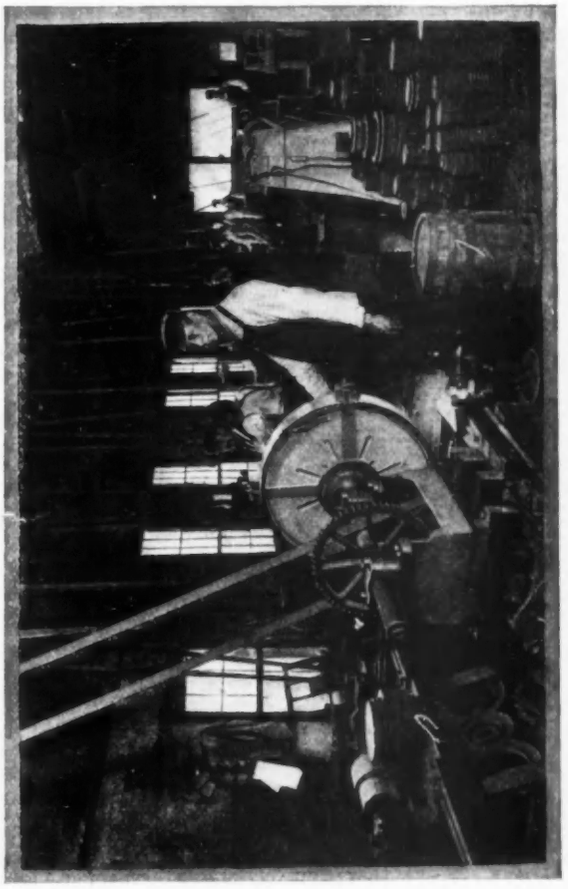
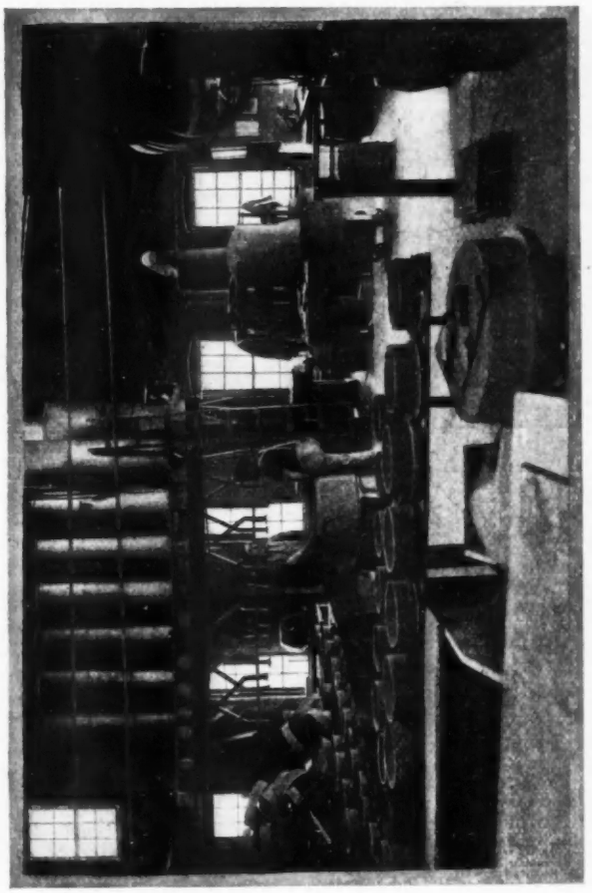


Fig. 2. SHAVING VITRIFIED WHEELS.
Fig. 4. TURNING VITRIFIED WHEELS.



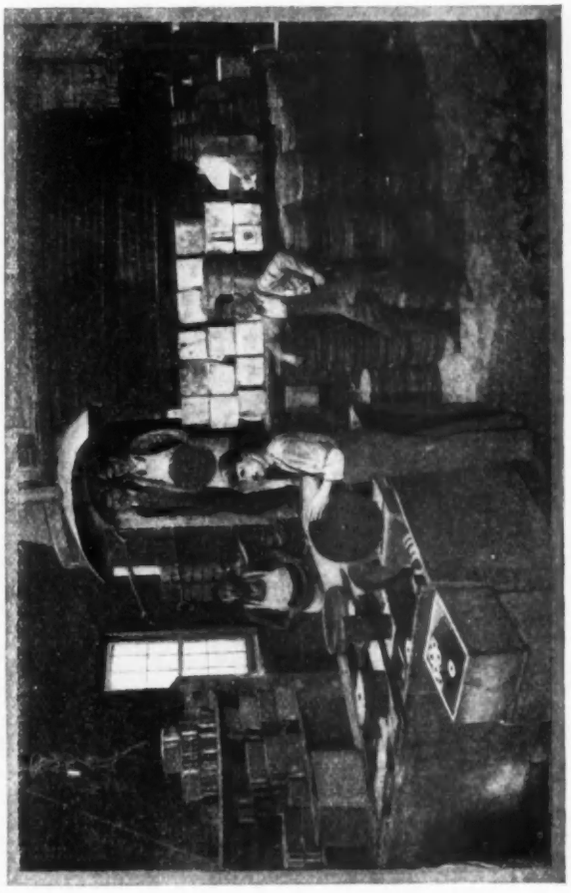


Fig. 1. MIXING ROOM.
Fig. 3. OPENING A KILN.

though a misdirected application of them can injure both. As the author truly says in his paper, "Strange as it may seem to the enlightened citizens of this country, a great ignorance exists as to the nature and uses of this material," and I would add it exists in places where we would least expect to find it.

HENRY HANSEN.

Detroit, Mich.

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Emery Wheel Manufacture.

The accompanying views show some of the operations of making emery wheels, as carried on at the works of the Sterling Emery Wheel Manufacturing Company, Tiffin, O. The first four of the cuts illustrate the evolution of the vitrified type of wheel, to which, until three years ago, the attention of that company was confined. The fifth, and largest figure represents a stage in the construction of their other process, the wire web wheel.

Illustration No. 1 shows the mixing room for vitrified wheels at the top of which will be observed large cans which hold about two tons of emery each. Underneath these cans is a weighing apparatus which enables the mixer to obtain the quantity of emery needed.

The wheels are held together by a material called the "bond." Their hardness depends upon the proportions of the various constitutents of this bond, as well as upon the length of time they are burned in the kiln. The degree of hardness is termed the "grade." In making up the wheels it is customary to mix together at once enough of the substances entering into their composition to suffice for several of the same grade and grain. Emery, water, and the materials to form the bond are put into large tanks, holding about fifteen hundred pounds each, and well mixed by hand for several hours, it being the belief of the company that this work cannot be satisfactorily done by machinery.

After mixing the material, which is then in a plastic form, is put into metal rings somewhat larger than the wheels should be when finished. A plaster of paris wheel, or "bat," is under the ring so that the water from the material will quickly be absorbed. When this operation is completed, the wheels are put into the dry room, where they are left for a number of hours. They are then transferred to another dry room where the temperature ranges still higher.

When they have been thoroughly dried they are taken to the shaving room shown in Fig. 2. The machines operated here are known as "jiggers," and with them the wheels are trued and cut down to nearly their proper size, allowing only enough for contraction while being burned. After this has been done they are in condition to be put into the kilns, one of which, in the process of opening, is shown in Fig. 3. The wheels have to be carefully packed in the kiln on fire clay bats with fire clay rings around each, so as to insure their being burned evenly. They are then submitted to a heat of nearly 2,500 degrees, Fahr., for from sixty to eighty hours. After burning, it requires fully forty-eight hours for the kiln to cool sufficiently to permit the removal of the wheels.

Cut No. 4 shows the wheels being turned so as to make them the size desired and true. A large blower will be observed next to the window. This is intended to remove all dust resulting from the truing operations.

Fig. 5. TAMPING WIRE WEB WHEELS.

The remaining figure relates to the manufacture of wire web wheels, which, as made by the Sterling Company, are known by the brand "Advance Safety." It illustrates one of the most important operations in the process of their manufacture, called "tamping." After the wire web wheels have been molded, they are heated in a kiln, but not to so high a temperature as that at which the vitrified wheels are burned. Subsequent

to removal from the kiln they are turned or trued, in the same way as the vitrified wheels shown in Fig. 4.

All wheels are bushed with lead before leaving the factory and are taken to the testing room where they are run at a speed of more than double that for which they are recommended. This is done as a precaution against the breakage which might result from a latent crack or flaw. They are tested by experts to see if their grade is correct for the work for which they are intended, as great care has to be exercised in this respect. The wheels are then labeled, and are ready for packing and shipment.

The Sterling Company was originally located at West Sterling, Mass. It is exporting wheels to almost all manufacturing countries.

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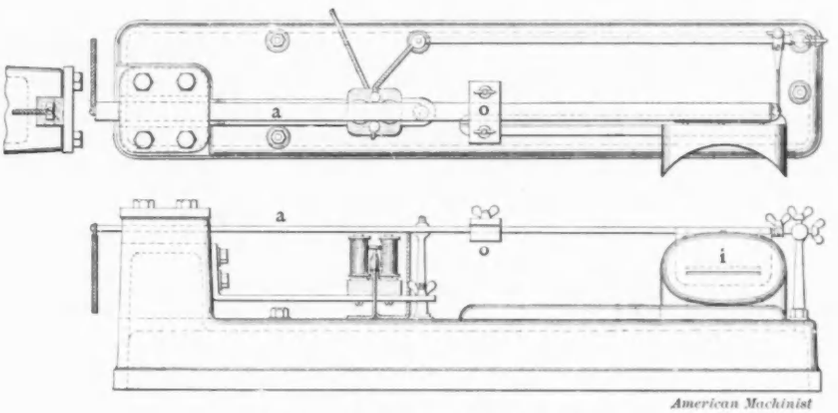
A Delicate Speed Indicator.

The Ball & Wood Company, of Elizabethport, N. J., is using an instrument for determining the instantaneous variations of speed which occur upon the best engines of the day. The rod *a* is rigidly held at the left hand end as shown, and is kept continuously vibrating by means of an electro magnet in a make-and-break circuit. The speed of vibration is adjusted with the greatest nicety by sliding the weight *o* along one way or the other. Near the free end of the rod is a horizontal slit *i*, and in front of the rod is a fixed screen with a slit to correspond. As the rod vibrates, the passage of its slit in front of the slit in the screen leaves a clear opening through both at one instant of each vibration.



A DELICATE SPEED INDICATOR.

When an engine is to be tested the vibrator is first set to the required number of vibrations. This number of vibrations, or of passages of the rod slit across the screen slit, will be the number of revolutions of the engine shaft, multiplied by the number of arms in the wheel. The instrument is so placed that when one arm of the fly wheel or pulley is horizontal, it will be directly in front of the slit in the screen and the observer looking through the slit will see the arm and nothing else. Starting the vibrator when the wheel arm is in line with the slit, the arm will seem to be stationary as long as the speed of rotation coincides with the speed of vibration. If the rotation is slower the arm will seem to move backward and uncover the slit, while if the rotation is faster, the arm will be seen to advance and uncover the slit in the other direction. The device is found to be of great service in adjusting the governors before the engines leave the works, and enables variations of speed to be readily seen which are so small as to make them escape detection by any of the ordinary methods.

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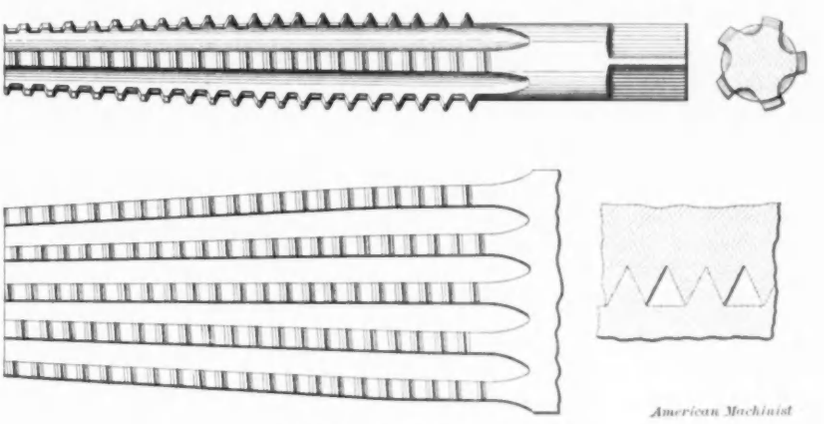
A Suggestion in Tap and Die Making.

The essential features of a recent patent are shown in the accompanying cuts. The invention embodies an attempt to improve the common tap, as used for tapping nuts and similar purposes. It is also applicable to dies for bolt cutting, but it is not necessary for us to show more than the tap. The inventor claims that with the common tap, each wing as it sweeps around entirely covers the surface which is being cut, sweeping it clean, not only of chips, but also of the necessary lubricant. Although the tap may be flooded with oil, it can scarcely be assumed that this oil is always shooting longitudinally along the tap with sufficient force and velocity to fill each revolving groove. The idea proposed, then, is simply to cut away every other tooth on each wing of the tap, so that each cutting tooth will be preceded and followed by an opening for the oil to flow. No further explanation seems to be required. An odd number of flutes to the tap is required to carry out the principle. The number of cutting teeth upon the tap is reduced one-half, and while the tap may cut somewhat easier, it should also wear out faster. It is claimed that on this tap the teeth require no side relief, the alternate spaces between the adjacent cutting points allowing the screw thread to yield slightly under the cut. The patentee is Frank G. Echols, of Hartford, Conn.



A SUGGESTION IN TAP MAKING.

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Paper Friction Wheels.

BY M. W. DANIELSON.

Of the eight kinds of paper friction wheels which I have had the privilege of testing, only one or two apparently filled all the requirements. These eight kinds are as follows: (1) cast, (2) disk, (3) molded, (4) wrapped, (5) laid, (6) blocked, (7) wound, and (8) pressed. Each kind is made according to a special plan, and in most cases each plan is the outcome of a different man's experiments. The casting method is always popular in experiments, but is very defective. The paper or wood pulp is bought outright and cast in common foundry flasks. One of the halves for a wheel thus cast is shown in Fig. 1, No. 1. The halves are trued, finished off smooth and cemented to a cylindrical form of iron, and the latter is keyed or set-screwed to a shaft hub. The shape of the halves is maintained by side flanges of iron bolted on. My tests demonstrated that the faults in this style of paper friction wheel were due to the evident sponginess of the entire friction surface. It is evidently impossible to cast a solid half from pulp free from air holes and minute defects which ultimately wreck the wheel.

I found that the casting troubles were overcome in the disk class of paper wheels, but only to give way to others.

These wheels, No. 2, are usually made of thin disks of straw board, cut in half circles, as in the cut, or in complete circles, and many thicknesses are clamped together, to form the wheel. The friction testing machines played havoc with the exposed edges of the disks, and the surface of each wheel was grooved in spots, due to the breaking out of pieces of the disks. Possibly future experimenters will show means to make the edges of the disks more compact and avoid this.

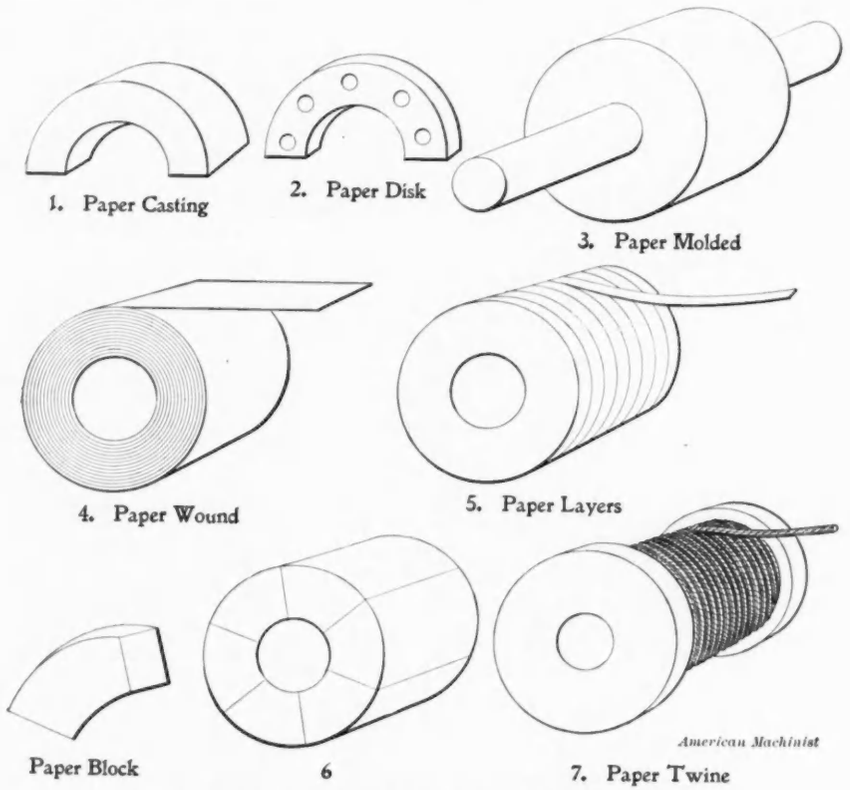

Fig. 1. HOW NOT TO MAKE PAPER FRICTION WHEELS.

I obtained fairly good results with the molded class of paper friction wheels. These No. 3 are made by hand molding a solid cylinder of the pulp on a mandrel, as shown. The mass of pulp is then pressed in a specially prepared mold. The pressing continues until the mass is well packed, then it is dried and finished off for a shaft hub. The defect in this kind does not develop at the tests, but the cracking of the shell from atmospheric causes renders this pattern imperfect.

The wound style, No. 4, certainly does away with many of the defects in the above classes. Paper (usually manilla) is tightly wound and cemented to the form and size of the wheel required. Peeling of the layers was the only trouble I found in these wound wheels when in test. This, I believe, can be remedied by using a firmer cement and by winding much tighter.

Design No. 5 cannot very well peel, as the paper is wound in narrow strips, as shown. The weak point in this pattern of friction wheel was the irregularity developed in the contacting surface, caused by the strips sinking slightly in some places.

I thought that the block style would fill the bill. This wheel, No. 6, is formed by setting six molded blocks of paper pulp to form the circular shape. The idea was that the pressure from frictional contact would tighten the taper pieces and help to increase the stability of the wheel. But the test pressures developed the reverse, and, regardless of tight bolts, etc., the blocks would loosen after a short run.

By winding paper twine about a flanged cylinder we get No. 7. Several of these wheels were at hand, but owing evidently to the shrinkage of the packing under the twine, the body was loose in every one of them, and no tests were made.

PRESSED PAPER FRICTION WHEELS.

I suppose that every man who experiments discovers something which may be done differently. As a sequence to my tests of the above paper friction wheels, as made by others, I produced what I term pressed paper wheels. These I cast in metal molds (see Fig. 2 for a half). The paper casting is readily slipped around and out of the mold as soon as the moisture is expelled from the material. This drying out may be hastened by baking; the casting shrinks enough to loosen it.

Instead of forcing the pulp into the mold, I draw it in by creating a vacuum; Fig. 3 shows the arrangement. The suction pipes lead to an ordinary air pump, and the vacuum in the cylinder draws the pulp from the box through the pipe *A*. All air being excluded, the soft pulp packs tight in the mold. I have a globe valve at *C* which I close tight, and draw the air from the mold by the vacuum pipe *B*. I then close the valves *D D*, open the valve *C*, and, of course, the pulp rushes through *A* into the mold. The first of the pulp to enter plasters itself against a wire mesh which I have at *E E*, inside the mold, and closes the same. The pulp that follows packs itself well inside the mold, but to complete the pack it is necessary to turn the pipe *A* up, and force more pulp into the mold with a rammer until the mold is filled.

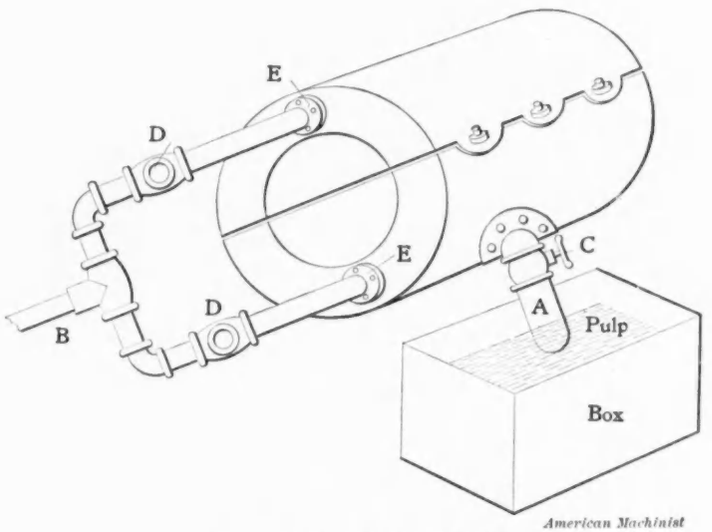

Fig. 3. VACUUM MOLDING.

I permit the casting to remain overnight in the mold, and next day remove it and submit it to roller pressure, as next shown, Fig. 4. The steel rolls are in adjustable bearings. The pressure with the rolling tends to harden the casting. I

next thoroughly dry the casting and put it on an arbor for finishing, as in Fig. 5. The pulp may be cast long enough for two rolls, cutting or dividing it at *a*. The finishing processes involved are, truing by the use of wood-cutting tools, sand-papering, filling by applications of emery flour, and polishing with tallow aprons. The castings may then be cemented and pinned to the iron shell, as here shown, Fig. 6. I used two grades of pulp in mak- woods, and the other grade (bought at a wood-pulp mill) was ground from white woods, and the other grade (bought at a paper mill) was made from old book and rag stock. I added some glutinous mat-

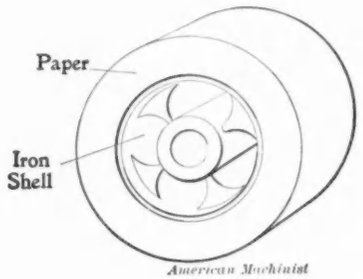

Fig. 6. THE FINISHED WHEEL.

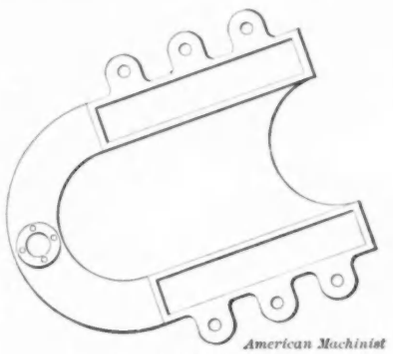

Fig. 2. HALF OF MOLD.

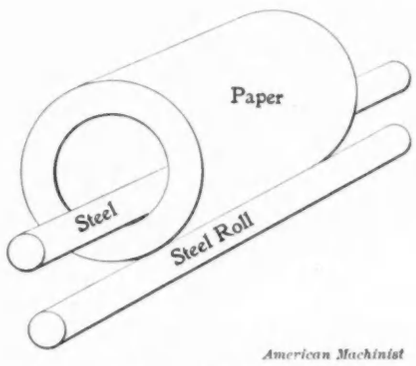

Fig. 4. PRESSING THE CASTING.

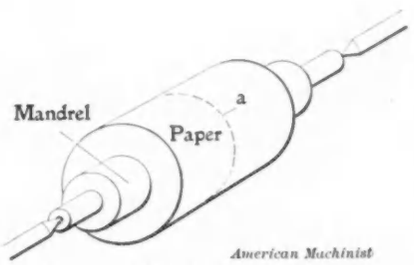

Fig. 5. FINISHING THE ROLL.

ters, borax, tallow and rosin. My tests proved that paper friction wheels made by casting the rim in one piece in a vacuum were free from air holes, and stronger.

My object is only to suggest one more way to make a paper friction wheel, and having given that, I need not continue. There are, I believe, no patents or copyrights on any of the methods described, consequently the field is free for others to explore.

▲ ▲ ▲

It is said that a patent is to issue for a substance harder than diamond. It is a carbide of titanium and was discovered by M. Maisson, a French savant. An oxide of titanium is used for coloring artificial teeth, which is the only practical use for the metal hitherto developed.

▲ ▲ ▲

The latest printing press installed in the press room of the New York "Herald" prints, pastes, folds and counts 96,000 eight-page papers per hour.

Letters from Practical Men.

Invention and Discovery.

Editor American Machinist:

I think your editorial entitled "Every Man an Inventor" is a trifle rough on that long-suffering class known as inventors. Of course, I cannot dispute your authority as to the original meaning of the term "invent," but the average man of to-day (no, we will say the majority of men of to-day) seems to regard it as being in some way different from discovery, and I hope to be able to show that the majority are right in this.

I do not wish to be understood as claiming the inventor to be at all superior to the discoverer, but simply that there is a distinction and a difference. It is true the materials that constitute the modern bicycle have existed since the beginning, and so has the gold in the Klondyke and the diamonds in Africa and Brazil, but what would the discovery of the diamonds have amounted to without the inventive genius that devised the means for cutting and polishing these gems and so unlocking the brilliancy hidden by the rough exterior? Possibly our earliest ancestors discovered iron, nickel, rubber gum and animal hides, but they evidently lacked the inventive power to transform these into steel, electro-plated ware, vulcanized tires or leather, let alone assembling them in the form we call the bicycle. The men who first stumbled upon iron ore and rubber trees are hardly to be classed with Bessemer and Goodyear, though had it not been for the discoveries of the former the inventions of the latter could never have come about.

I do not mean to be in the least irreverent when I say I consider an inventor a creator, but I cannot so class a discoverer. The one, using materials already created for him, yet transforms them into things which never before existed, while the other merely goes hunting for things which, while perhaps unknown to him, have always been in existence. The bicycle, as iron, has always existed, but as bicycle was created quite recently, and as a bicycle I hold it to be a creation of man, consequently man is a creator. Perhaps the man who discovered the iron contributed quite as much toward its final accomplishment as he who transformed that iron into the weldless steel tube; still it seems to me there is a vast difference in their work, both in methods and in results. I quite agree as to the possibility for every man of sound mind to become an inventor, but as to invention and discovery being one and the same thing I simply fail to see it.

E. R. PLAISTED.

Montpelier, Vt.

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Prices of Castings in Germany.

Editor American Machinist:

I have found it very difficult in America to get from foundries average prices for various weights of average work. In Germany, however, the thing is very simple. I apply for an estimate on any one piece, and I get a sheet which gives me the price per kilo for pieces of any desired weight (average work), so that I do not have to write again to the same foundry for cost of pieces of another weight. Such a price-list runs about as follows:

"Cash prices of malleable iron, steel castings and weld steel castings.

MALLEABLE IRON.

Kilograms per Piece.	Per Kilogram Net at Foundry.
Over 10	63 pfennigs
5—10	66 "
2½—5	70 "
1—2½	74 "
½—1	77 "
Pieces per Kilogram.	
2—5	84 "
5—10	90 "
10—20	98 "
20—30	105 "
30—40	110 "
40—50	120 "
50—60	125 "
60—100	140 "

Steel castings and weld steel castings, 10 per cent. extra."

The prices are the actual ones on July 26th at Dresden. Reckoning the kilogram at 2.2 pounds average and the pfennig as .24 cent, we have malleable pieces of 22 pounds and over costing 6.8 cents

per pound, while malleable articles weighing 27 to 45 per pound average, cost 15 cents per pound average.

ROBERT GRIMSHAW.

Dresden, Germany.

▲ ▲ ▲

Circles on Half-Size Drawings.

Editor American Machinist:

In making half size drawings, if the full size divisions of the foot, instead of 6 inches to the foot scale, are used to lay off the distances, it is often confusing to determine the radius for any given circle. As an illustration, suppose a 3⅝ inch circle is to be drawn. The draftsman mentally says something like this. 3⅝-inch half size is $1\frac{13}{16}$ inches; one-half of $1\frac{13}{16}$ inches is $\frac{29}{32}$ inch; then with a radius of $\frac{29}{32}$ inch he describes the half size 3⅝-inch circle.

In every case where a given distance is to be laid off equally on each side of a center line, this may be done without any calculation by simply using the 3 inches to the foot scale, and laying off on each side of the center line the full distance. In the above illustration, the draftsman would set his compass to 3⅝ inches on the 3 inches scale, and the circle described with that radius would equal the circle described with a radius of $\frac{29}{32}$ inch.

The reason is obvious: 3 inches to the foot is ¼ size, and the radius of a half size circle is equal to ¼ the diameter of a full size circle. C. C. H.

▲ ▲ ▲

The High Side of a Pulley.

Editor American Machinist:

There is an error in the position of one of the reference lines in Fig. 4, article "High Side of a Pulley."

The line from p_3 should point to the end of the line of which p_2 is the other extremity, and not to the edge of the belt as shown.

THE REPAIRMAN.

Syracuse, N. Y.

▲ ▲ ▲

"A Metric Compromise."

Editor American Machinist:

In regard to Mr. Sargent's letter under the above heading, I would say, as bearing upon the same subject, that having had occasion in Cuba, where the metric system prevails, to constantly go from one scale to the other, rendering it necessary to have some close and ready approximate method of transformation, I found that the best simplification was to call the meter 40 inches, instead of 39.37. It is most unfortunate that, being so near 40 inches, the meter is not so, exactly, as that would solve the whole difficulty at once, and make no legislation, one way or the other necessary. The only real difficulty lies in the fact that at present it is impossible to express one system in its exact equivalent in the other.

You see, at a glance, how convenient the 40-inch-to-the-meter approximation is: One inch equals exactly 2.50 centimeters, and 4 inches equals 10 centimeters. Therefore, to turn centimeters into inches, multiply by 4 and divide by 10 and vice versa. Also, 30 centimeters equal 1 foot, etc. In "land surveying," a closer approximation is 1 chain equals 22 yards, equals 20 meters; hence, very closely, 1,600 meters equal 1 mile. Also, 1 acre equals 4,000 square meters.

My impression is, that our Cuban mechanics, carpenters, blacksmiths, etc., when they had the choice, preferred working in inches rather than centimeters, but I did not investigate sufficiently at the time to draw any general conclusions. E. S. G.

Yonkers, N. Y.

▲ ▲ ▲

The Engine's Valve.

Editor American Machinist:

In "questions and answers" of August 12th, I notice the sketch of valve and seat furnished by J. K., also your suggestions as to a remedy for the trouble complained of. To these no exception can be taken; but a point or two has been

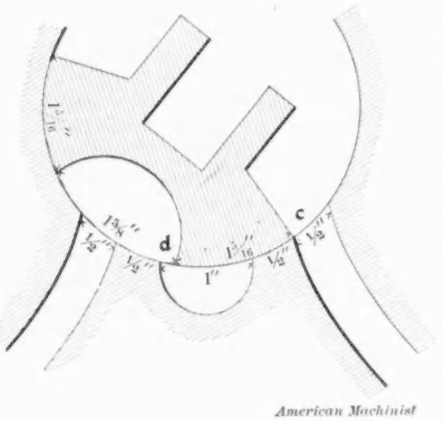


Fig. 1

overlooked I think, which will be shown by Fig. 1. This shows the same valve, with one port full open. At this position it will be seen that the exhaust port at *a*, is but 3-16 inch wide. This, no doubt, produces a good deal of back pressure, especially as the piston at this time has not attained its full velocity. If a little more travel were given to the valve, the effect would be to make two distinct exhaust reports at each stroke; a condition which I have detected in old engines having badly constructed valves, or deranged valve gear.

There seems to be a possibility that J. K.'s trouble in securing enough power from his engine may be due to too little travel being given the valve. The opening which I have shown at *c*, of ½ inch, will require a travel of 2¼ inches, whereas he states it to be 1¾ inches. If the latter is correct, then the port at *c* only opens ¼ inch, which is clearly insufficient, especially when the port is only 4⅞ inches in length. It is the practice with most builders, I think, who use this form of valve to make provision in the rocker arm by which the travel of the valve may be increased or diminished at will. The wisdom of such license being granted every engineer is probably questionable. It is quite likely that a hammer and chisel in competent hands might improve this engine.

QUIRK.

▲ ▲ ▲

Fire Pails in a Foundry.

Editor American Machinist:

Tecumseh Swift's article on "Fire Pails" reminds me that I have had some little experience with them. Some few years ago, when in charge of a foundry in New York State, the fire company required us to put up shelves in different parts of the shop, with six pails on each. We did so. Now, you must remember this is a foundry—not a machine shop, as I presume that is what Tecumseh Swift alludes to. The trouble was, to keep the pails on the shelves. I would miss one and go around to find it; at last I would find it on a man's floor. "Don't you know that you are not allowed to use those fire pails?" I asked the man.

"I did not take it down; I found it over there."

I could not catch anyone taking them from the shelves, so could do nothing. The superintendent missed them from the shelves sometimes, and hauled me over the coals about it. I told him that I could not stop and watch the pails all the time. "Well," he said, "I'll fix them." So he went off into the office. In about a week's time there was a new lot of pails there with round or hemispherical bottoms. They were put on the shelves, bottom side up, with a barrel of water under them. So I thought the pails would stop there till they were needed in case of a fire. But talk about discipline in a foundry; they may get it in the machine shop, but it seems to me that the molders get too much sand or grit in them to be under any rules. The pails would go off the shelves as before; but as they would not sit on the floor without tumbling over, all they had to do was to stick them in the sand heap. So you see there is a little ingenuity in the molders, even if they cannot be disciplined.

THOS. WATHEY.

Cleveland, O.

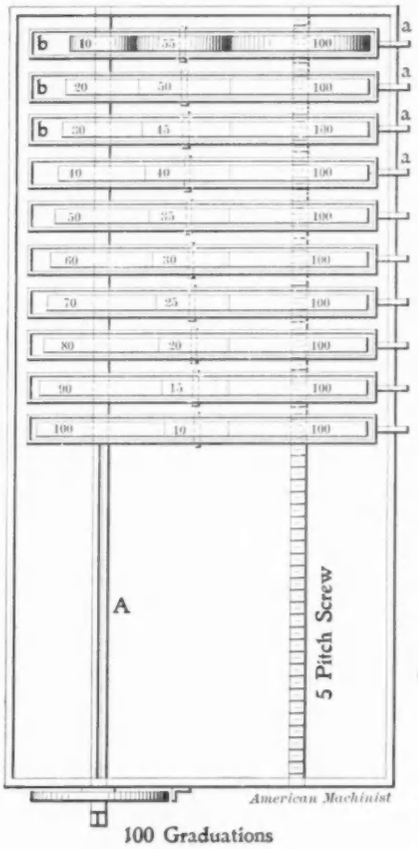
▲ ▲ ▲

That Special Mechanical Movement.

Editor American Machinist:

I enclose a sketch of a device for moving the pins as required by H. E. C. in your issue of June 3d. The pins to be moved are at *a a a*. These are attached

to the ends of the rectangular frames *b b b*, which enclose the sets of gears used to give the desired movement. The splined shaft *A* has upon it a number of sliding



gears with numbers of teeth increasing successively by the addition of a constant number. The long fixed screw has upon it a number of gears with threaded hubs to fit the screw and each having the same number of teeth. The intermediate gears have the required number of teeth to connect the drivers with the driven gears. When the shaft is turned the gears on the screw and the frames *b b b* with the pins *a a a* are advanced at different speeds, or are moved different distances as required. The distances that the pins are moved may be determined by the graduated wheel on the end of the shaft *A* outside the frame. The frame must of course be made proportionately longer than shown in the sketch. B. C. N.

[The above device illustrates, as too many "inventions" do, the difference between theory and practice. Theoretically it seems to be all right. The turning of the shaft would advance the pins in such a way that though the spaces between them would be increased, they would still be equal, if it were not that some conditions, sure to assert themselves as soon as any movement occurred, are overlooked or ignored in the theory of the thing. To have everything work as assumed it is very necessary that the traveling frames *b b b* should always be at right angles to the shaft, and no means are provided to ensure this. When the gears on the screw were turned and moved along, the gears on the shaft should be slid along correspondingly, and the frames *b b b* are depended upon to do the pushing, but it is evident that they would drag and cramp and skew the gear on the screw until it would be impossible to turn anything. The pins also, in consequence of the obliquity of the frame, would not be absolutely equidistant, nor exactly perpendicular to the slide. The theory of this device also ignores the very practical condition of cost which is fatal to many theories. The device would evidently be an expensive one if otherwise all right.—Ed.]

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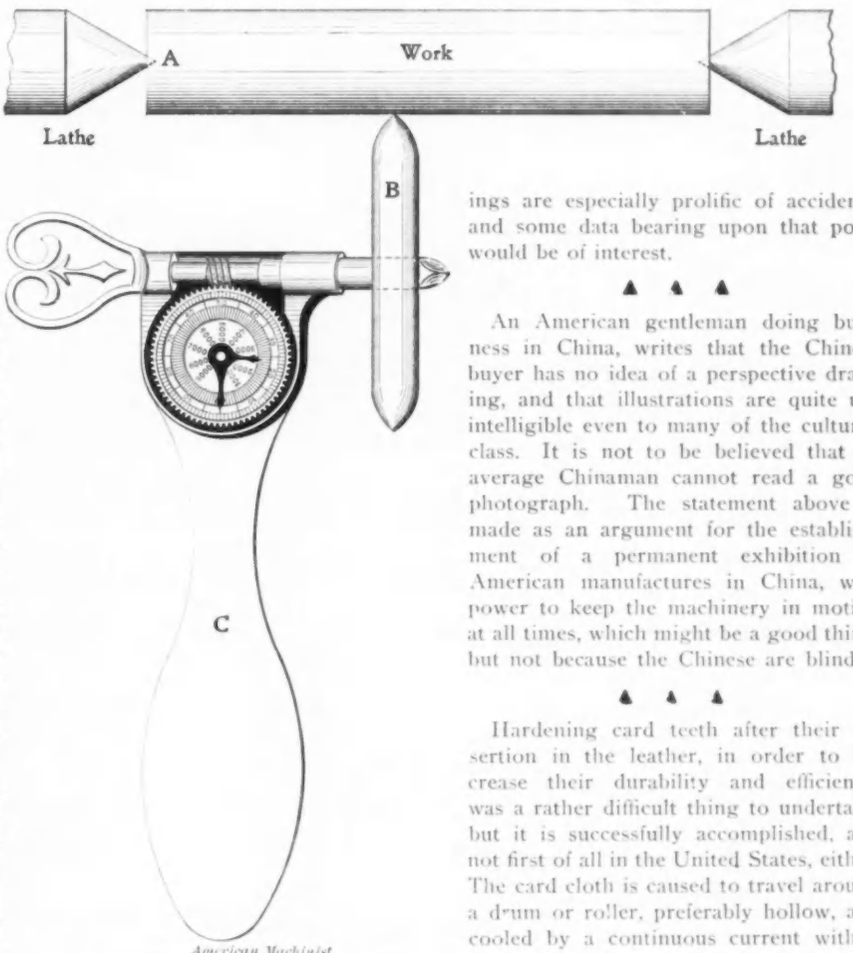
Device for Determining Cutting Speed.

Editor American Machinist:

I hand you herewith a sketch of a small instrument which I showed to Prof. Sweet when he was here, and which permits me to determine at once the speed at which any tool is cutting, when using a lathe or planer.



DEVICE FOR DETERMINING CUTTING SPEED.

As will be seen, I use for this purpose a revolution counter, which is made by Starrett, on which I have fixed a handle, *C*, and on the spindle I placed a small wheel, *B*, made of wood, which is 63.7 millimeters in diameter, or 20 centimeters in circumference.

Placing this against the moving work, and counting the number of revolutions which *B* makes a minute, I at once know the cutting speed of the tool.

ARTHUR BOLLINCKX.

Brussels, Belgium.

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The Distribution of Accidents.

A writer in an English periodical having stated that 75 to 80 per cent. of the accidents in engineering shops occur before breakfast time, Laird Bros., the great shipbuilders of Birkenhead, have given out the following figures from their accident book for the last two years: 6 A. M. to 8:15 A. M., 17 per cent.; 9 A. M. to 1 P. M., 50 per cent.; 2.15 P. M. to 5:15 P. M., 29 per cent.; 5:15 P. M. to 6 A. M., 4 per cent. The last item covers only the operations of night shifts in two departments. Probably nearly all machinists have a belief that Monday mornings are especially prolific of accidents, and some data bearing upon that point would be of interest.

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An American gentleman doing business in China, writes that the Chinese buyer has no idea of a perspective drawing, and that illustrations are quite unintelligible even to many of the cultured class. It is not to be believed that an average Chinaman cannot read a good photograph. The statement above is made as an argument for the establishment of a permanent exhibition of American manufactures in China, with power to keep the machinery in motion at all times, which might be a good thing, but not because the Chinese are blind.

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Hardening card teeth after their insertion in the leather, in order to increase their durability and efficiency, was a rather difficult thing to undertake, but it is successfully accomplished, and not first of all in the United States, either. The card cloth is caused to travel around a drum or roller, preferably hollow, and cooled by a continuous current within. Under the roller there is a vessel containing a bath of suitable hardening liquid and at the side of the roller, near the surface of the bath, a sharp flame acts on the extremities of the card teeth as they pass, heating them sufficiently for hardening without injuring the material which carries the wires.

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Why Is It?

Many of the best and most important machinery manufacturing concerns in this country, and in Europe as well, not only subscribe for, but carefully preserve and bind into volumes their copies of the "American Machinist."

A large share of the correspondence of this office springs from the fact that there are others who do not do this, and who therefore occasionally feel impelled to write us for back numbers that we cannot supply, or for information about articles that we cannot give. Very many of the concerns whose work is best known throughout the world constantly consult the volumes of this paper to see what has been done or placed on record bearing upon the problem at the time presented to them. Why it is that there are so many others that fail to make use of this easily obtained means of availing themselves of the experience of others, and avoiding their mistakes, is a problem for which there seems no reasonable answer.

▲ ▲ ▲

Book-Makers.

It seems to us very desirable that there should be, if possible, some sort of a combination effected between those who are skilled in the art of getting up technical books with little technical knowledge to base their writing upon, and those, on the other hand, who have the special technical knowledge, but know little or nothing of the art of putting that knowledge into the concrete form of a book which shall be of use to others.

We all know the aggravating experience of consulting books made by the professional book-makers, which tell us nothing we need to know, for the simple and sufficient reason that their authors do not know enough to tell anybody anything new of the subject of which they write. On the other hand, an equally trying experience is to waste time trying to get information out of a book, the author of which evidently possessed the desired knowledge and intended to impart it, but failed only for lack of skill in the art of book making. We wish these two classes of men, or the talent of the two classes could be united in some way. There would be fewer books, perhaps, but the ones published would be better ones.

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Improved Metropolitan Traction.

In a recent interview, President Vreeland of the Metropolitan Traction Company, of New York, which now embraces the Broadway cable line, four other parallel lines traversing the island longitudinally and numerous crosstown lines, intimated, if he did not formally announce, that ultimately the entire system will be operated by the underground trolley. This has been an apparently foregone conclusion for a long time. The work of construction is being pursued rapidly, and some of the lines will be running by electricity before the beginning of the next year.

The problem of surface traction in New York must always be a difficult one. Whatever system of traction may be employed, a sufficient number of cars cannot be run on Broadway to carry the passengers even now, and the number demanding transportation must continually increase, on account of the continual increase of office and business capacity in the sky-scrapers.

Mr. Vreeland's scheme for the relief of Broadway consists in arrangements for drawing off some of the through or long-distance traffic to the parallel lines, which are none of them as crowded as Broadway, nor likely to develop any vast increase of local patronage. The cars, as soon as they reached the side lines, would be less crowded, would be less liable to interruptions, and would make better time for the passengers. For all-around convenience of operation, and especially for rapidity of transfer from line to line and adaptability to the various conditions of a fluctuating traffic, Mr. Vreeland argues that the underground trolley is much to be preferred to the cable, in all of which he is no doubt correct.

It is evident that the public is to be better served than it has been of late, and that is the main thing; but whether even now we have in sight the absolutely permanent solution, may still be doubted.

It is probably true, as Mr. Vreeland states, that at the time horses were abandoned for the Broadway cars, the cable was the best substitute; if now, after a lapse of five years, electric traction has so far progressed as to make it economically possible to throw away the cables and the machinery for driving them in order to use electricity, then the fact speaks eloquently of the rapidity of latter day progress. It is probable, however, that electricity would have been used in the first place if overhead trolley wires had been permitted on Broadway.

It is to be noted, at the same time, that Mr. Vreeland especially speaks of the greater flexibility of electric traction, and of its facility in transferring cars from one line to another. While it is true that the electric trolley has the advantage of cable traction in this respect, it yet has not this advantage to the extent that some form of motor would have which would enable each car, while on the road to be independent of the power-house; i. e., to carry with it, in some form, sufficient stored energy to make its run. The steam locomotive being out of the question, it then becomes a matter of choice between storage batteries and compressed air motors; but whichever of these it may be finally, it is our belief that the ultimate motor car will carry its own propelling force and be able to go where it listeth.

▲ ▲ ▲

Dollar Wheat.

These are the days when the sun of prosperity shines on the farmer, and if there is in all the land a mechanic who does not rejoice that the toiler of the field gets his reward we cannot understand him, and we certainly are not in sympathy with him. No more than an intelligent selfishness is needed to induce us most heartily to congratulate the farmer that his day has come. Good crops at good prices, and the prices reached before the farmer has sold his crop, so that he rather than the speculator gets the best of it, mean much for all of us. The farmer will have money to spend, and he will spend it. He will spend it to get the most out of it, which means that he will spend it to get the most out of the manufacturer and of every worker in the shop. He will not give his money away or throw it

away, but will exact honest labor for it, and that means work for us. He will buy a new wagon or a new buggy, and new farm tools, and he will fix up around the place, have an addition to the house or a new barn and a coat of paint all around. He and his folks will have some new clothes and perhaps go visiting a little, and all these things mean work and money for us. Everybody is bound to feel better in spite of politics and every other drawback.

The farmer's day is our day. And while the mechanics of the land must universally rejoice with the farmer, let him not forget his obligation to the mechanic. Dollar wheat he has been sighing for these many years. To-day he gets it, and getting it he gets more than he has looked for, and the mechanics have secured it for him. While wheat has gone up almost everything that he can buy with his money has become cheaper. The vast and rapid advances in means and methods have made the day's work standard a continually advancing one. Combined industry and ingenuity have made every man more productive of all material good. While we have each been seeking our own ends we have still been helping and lifting each other. There are many things that are not right, and many things to be done to right them. Few of us get all of our own and some get more than their just share. We are far from being content with our lot, and we ought not to be, but we ought to believe that our affairs are in the main progressing in the right direction even though it may seem to us that there are at times discouraging wobblings and retardations.

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Electric Steam Pipe Repairing.

As we noted last week, the coal bin failed at the Edison Electric Station, Paterson, N. J., and the coal buried the boilers and broke off some of the steam pipes. The works were of course got in operation as soon as possible. An "electric" journal, in fulfillment of its function, comments upon the incident as follows:

"The celerity with which a temporary service was given is a remarkable illustration of the flexibility of electrical methods. No other system of supply from a central point, such as a gas works, water works, cable railway, or the like, could possibly have been even in partial operation within thirty-six hours after such a calamitous occurrence as that which wrecked the station in Paterson."

It will be news to the mechanical world that boilers can be dug out and steam pipes can be repaired quicker in an electric plant than in, say, a machine shop.

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A press despatch dated Dubois, Pa., August 27th, reports that the railroad shops of the Buffalo, Rochester & Pittsburg road at that point were closed down indefinitely, on account of the falling off of business, due to the coal miners' strike.

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The 1900 Exposition.

Major M. P. Handy, who was prominently connected with the Chicago Exposition, and who has been appointed United States Commissioner to the Paris Exposition of 1900, sailed a few days ago for France, where he will investigate and obtain the fullest possible information regarding the exposition, and upon his return will prepare a report to Congress, which it is expected will form the basis of legislation by that body. Major Handy reports a very remarkable degree of interest in the Paris Exposition, and that it now appears as though American manufacturers would be very fully represented.

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Personal.

Passed Assistant Engineer D. C. Redgrave, U. S. N., is ordered as assistant inspector of machinery at the Columbian Iron Works.

Passed Assistant Engineer G. W. McElroy, U. S. N., is ordered to Clemson Agricultural College, Fort Hill, S. C., September 10th.

Mr. Frank E. Thompson, of the Pratt & Whitney Co., has resigned to accept, September 1st, the position of general superintendent of the Davis & Egan Machine Tool Co., at Cincinnati.

Mr. Chas. H. Kingsbury, who for some years was with the C. & F. Machine Tool Co., has been placed in charge of the Boston branch of the Niles Tool Works Co., at 65 and 67 Oliver street, Boston, Mass.

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Obituary.

A press despatch from Chattanooga, Tenn., dated August 23d, says: John T. Long, a workman in the Cincinnati Southern Railroad shops, while jacking up a car, was instantly killed, the handle of a jack striking him on the head. Master Mechanic P. H. Schreiber, who was standing a few feet away and witnessed the accident, fell over in a fainting fit, from which he cannot be aroused. Mr. Schreiber has been troubled with heart disease for some time, and his physicians say he cannot survive the shock.

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Technical Books.

THE FLOODS OF THE MISSISSIPPI RIVER; Including an Account of their Principal Causes and Effects, and a Description of the Levee System and Other Means Proposed and Tried for the Control of the River, with a Particular Account of the Great Flood of 1897. By William Starling, Member A. S. of C. E., Member Inst. of Civil Engineers, Chief Engineer Lower Yazoo Levee District, Greenville, Miss. Engineering News Pub. Co., New York.

This book, though written by an engineer thoroughly familiar with the engineering side of his subject, is yet so written as to be readily understandable by the lay reader, and besides being interesting, ought to help to remove much of the popular error regarding the Mississippi floods and the available means of controlling them. It is reprinted from the columns of the "Engineering News," is bound in paper, has 58 7 x 10-inch pages, and is sold at 50 cents.

THE PRACTICAL RUNNING OF AN ICE AND REFRIGERATING PLANT. By Paul C. O. Stephansky. Angel Guardian Press, Boston, Mass.

This is a book written by a man who has evidently had practical experience and knows thoroughly how to manage the class of machinery referred to. But he knows little or nothing of the art of book-making; his command of English is not complete. The engravings are not good, and the index is as bad as an index can possibly be; and yet this is a book which no mechanic or engineer who has to do with refrigerating machinery can afford to be without, simply because its author possesses knowledge of a special art and succeeds in imparting that knowledge with sufficient clearness to be understood. Which, after all, is the best thing that can be said of a technical book. One hundred and sixteen pages, 6½ x 4½ inches; cloth, $2.

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The Belgian railways have adopted the system of numbering the hours of the day consecutively from 0 to 24, either, according to circumstances, designating midnight. Noon is still 12 o'clock. The clock movements are not to be changed, but supplementary figures are placed on the dial for the second revolution of the day.

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News of some importance to bicycle manufacturers is to the effect that an agreement has been reached between leading bicycle tube makers in America and Birmingham, by which no one will be supplied under a certain fixed price, and it is claimed that every tube maker will be compelled to join the organization.

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It is reported that at a conference of the Southern and Northern furnace interests held in Chicago recently, it was agreed to advance foundry iron 25 cents to 50 cents per ton. It is expected that if this present move is successful, other advances may follow.

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Commander J. A. Howell, President of the United States Armor Factory Board, is inspecting the works of the Illinois Steel Company, of Chicago, it is said, with a view to the possible establishment of a government armor plant there.

Commercial Review.

NEW YORK, Saturday Evening, August 28.

MILL AND MACHINISTS' SUPPLIES.

The tendency in these lines is toward improvement. Inquiry is decidedly better than it was a few weeks ago, and the actual volume of sales is slowly augmenting. As one of the concerns who notice this change most unquestionably inform us, people are becoming more ready to buy, and when they do so they are in a hurry for their goods. So another large house find it, who report that there is less "shopping" now; that when a man wants to buy an article, he sends in and orders it, instead of taking occasion to overhaul all the stock of the store before he finds out what his own ideas are.

Factories have opened up after their summer shut-downs, and, since the middle of this month, it has been the normal season to see more activity in the supply trade. Then, of course, confidence is growing, and almost all lines of business are taking fire, one from another. It is evident that the glory of a reviving market for supplies must be divided between these two causes—the season and the times.

HIGHER PRICES EXPECTED.

Dealers believe that prices almost all around show a strengthening tendency. They have already advanced in pipe and fittings, while in most other lines there

(*Continued on page 35.*)

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Business Specials.

Gear wheels, gear cutting. Grant; see page 16.

E. H. Randall, Tool Buyer. See page 9, this issue.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Ct.

Brass castings. Write H. D. Phelps, Ansonia, Ct.

Inventions developed, drawings and models made. Green Bros., 5 Beekman St., New York, Room 524.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Gear and milling cutters, adjust. reamers, counterbars and tools, vert. millers, drill pr., cutter and surf. grind., shears. R. M. Clough, New Haven, Ct.

Cost of Manufacturing—Experienced manager will establish system of costs, giving exact account of every detail. Charge based on saving effected. Correspondence solicited. Geo. C. Thomas, 99 Nassau Street, New York, Room 212.

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Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday Morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

Mech. en., exp. sup. & head dr. Box 156, AM. MACH.

Machinery designer, 6 years best exp., technical graduate, moderate wages. Box 148, AM. MACH.

Pos. by mech. draftsman; exp. on wood working and gen. mchy; photographer. Box 166, AM. MACH.

Draftsman and M. E. (Lehigh) desires pos.; 17 mos. exp.; salary mod.; best refs. Box 159, AM. MACH.

Mech. draftsman, 8 yrs. exp., stm. eng. and gen. mchy., wants pos.; mod. terms. Box 182, AM. MACH.

Pattern shop foreman desires pos.; 10 years foreman's experience; references. Box 183, AM. MACH.

Mech. eng'r wants pos. as representative, estimating or as drafts.; 14 yrs. exp. Box 186, AM. MACH.

Experienced, all-around mech. draftsman desires position; moderate salary. Box 187, AMER. MACH.

Draftsman, mech'l, with tech. education, wants sit.; 11 years' all around experience; also convrs. with civil eng. work. Box 158, AMER. MACHINIST.

Practical toolmaker and draftsman wants work; exp. in gun, sewing machine and typewriter work; experi. work a spec. Address Box 165, AM. MACH.

Wanted—By a thorough prac. mech., die sinker and tool mkr, pos. as asst. supt. or frmn.; good manager of help and a hustler. Box 180, AMER. MACH.

Exp. mach. shop foreman, practical toolmaker and designer in large bicycle fact'y, desires change; corres. solicited; best refs. Box 175, AMER. MACH.

Designer, draftsman, machinist and toolmaker, 15 years experience here and in Europe, desires permanent position of responsibility; hard worker; State of New York preferred. Box 173, AM. MACH.

Young, competent, reliable and practical mechanical draftsman wishes situation; college education; 8 years shop and drawing room exp. on gen., auto. and printing mchy. Box 185, AM. MACH.

Wanted—Position by A1 toolmaker, used to gun, sewing machine, bicycle and similar work; capable of handling help by modern methods; quick, accurate and reliable, will go any where; best of references. Box 178, AMERICAN MACHINIST.

Wanted—Position, by a thoroughly practical and A1 designer and draftsman; exp. genl. and printing mchy., engs. and locomotives, also shop practice; would like pos. as traveling representative for first class co. 30 years, Address Box 176, AM. MACHINIST.

Pos. wanted as supt. or general foreman by mechanical expert; large experience in shop management; up in mod. meth. and a pusher; Corliss and automatic engines, mech. tools and general heavy work; strictly temperate. Box 179, AM. MACHINIST.

Wanted—To change position as foreman machinist, tool maker or instructar in manual training school by a thorough and practical machinist and tool maker; seven years' experience as foreman; good execut'e ability; A1 ref. Box 181, AM. MACH.

Foreman, experienced, practical and thoroughly competent in the manufacture of small, high grade interchangeable machinery, desires a position as general foreman or assistant superintendent; now employed as general foreman but wishes to change; first-class designer on jigs, fixtures, etc. for accurate and rapid production; can handle all classes of help, and is up in modern methods; eight years experience on tools, experimental work, etc.; seven years as foreman; good references. Address Box 184, AMERICAN MACHINIST.

Help Wanted.

Agents in ev'y shop for "Which Way" Levels. Sell on sight. Write at once to E. G. Smith, Columbia, Pa.

Wanted—Manager to take charge of the plant of a well established manufacturing co.; must take a monied interest. Address Box 161, AMER. MACH.

Drop Forgings—A large plant is being put down in Birmingham, Eng., with vacancies in all depts. Apply first to Billings & Spencer, Hartford, Conn.

Wanted—A thoroughly competent supt. to take charge of mod. mch. shop employing 100 to 150 men; must be reliable and able to handle men to advantage.; technical man preferred; state age, reference, experience and salary expected. Address Box 174, AMERICAN MACHINIST.

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Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d h'd lathes & planers. S. M. York, Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Boye, Cincinnati, O.

We make a specialty of Shartle's patent safety set collars. Prices low and samples free. Middletown Machine Co., Middletown, Ohio.

Patent right, special tools and machines for sale; good article to manufacture with other machinery. Box 146, AMERICAN MACHINIST.

For Sale—Small machine shop, having good repair trade, in town of 1,400 inhabitants; no opposition. Box 171, AMERICAN MACHINIST.

Model Locomotives—Complete castings, latest N. Y. Cen. standard, up to date; 4c. in stamps for cat. alog. G. H. Olney, 163 Herkimer St., Brooklyn, N.Y.

Lathes, planers, drills, milling machines, vises, also brass working machinery second-hand; must be modern and in first-class condition. C. C. Wormer Machinery Co., Detroit, Mich.

Wanted Capital, $10,000—A one-half interest in an established machine tool company is offered a practical man having the executive ability to conduct the business. Strictly modern shop and equipment with ample orders. Address Box 49, AMERICAN MACHINIST.

A machine shop, with modern equipment, heavy and light machinery, cranes of 20 tons capacity and 10,000 square feet of unoccupied floor space, would contract to manufacture any kind of machinery. Parties already having machinery built under contract might do well to write us for estimates. Box 62, AMERICAN MACHINIST.

"COMPRESS"

Patent Polishing Wheels.

Leather, Felt, Canvas.

For Catalogues and Prices, address:

THE COMPRESS WHEEL CO.

No. 16 N. Canal St., Chicago.

Sales Agents: ∴ ∴

THE HANSON & VAN WINKLE CO., Newark, Chicago.

CHAS. CHURCHILL & CO., London.

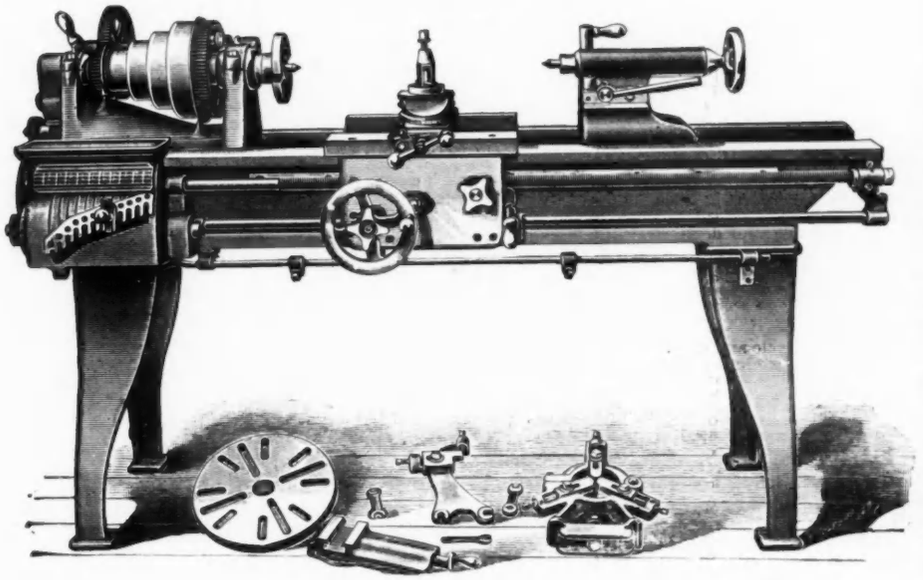
Horizontal Spindle Milling Machine

I mean Business, and can cut right along for eight feet. Don't you want me? I have a BROTHER that can BORE.

Write to BEAMAN & SMITH,

PROVIDENCE, R. I.

THIS LATHE COMBINES THE LATEST AND BEST IMPROVEMENTS.



14 in. x 6 ft. Hendey-Norton Lathe

With Improved Automatic Stop.

• • •

AUTOMATIC STOP

It is durable, simple, indispensable. It will automatically stop the carriage in either direction. It is equally efficient whether feeding or thread-cutting, running up to a shoulder, boring to bottom of holes, or internal thread-cutting. No danger of spoiling either tool or work. It is a safeguard against accidents in either direction.

CARRIAGE

The carriage reverses in apron; no slamming of countershaft. There is no comparison between this lathe and the old style or common lathe.

THREADS

It has all threads in daily use with simple movement of lever.

FEEDS

Has all feeds in daily use with simple movement of lever. Send for Circular.

• • •

THE HENDEY MACHINE COMPANY,

Torrington, Conn.

Agents for the Pacific Coast, PACIFIC TOOL AND SUPPLY CO., San Francisco, Cal.

European Agents, { CHAS. CHURCHILL & CO., Ltd., London and Birmingham. SCHUCHARDT & SCHÜTTE, Berlin and Vienna. EUGENE SOLLER, Basel Switzerland.

(Continued from page 34.)

have, as yet, been no official changes. Some of those in which probable advances ere long are rumored are asbestos goods, belting and brass goods. Twist drills, on the contrary, are weak. A report has it that a reduction of 10 per cent. has been made; but this is not entirely accurate. The representative of one twist drill manufacturing concern informs us that he has lately been devoting himself to leveling off prices; i. e., giving to all of his customers prices which, although no lower than some which had been made before, might amount to as much as 10 per cent. reduction in certain cases.

It is said that the price of imported files is being raised, as a result of the new tariff. The advance may be about 10 per cent. American files were slightly advanced in price a few months ago, and possibly the finer files made in this country will rise to higher figures in sympathy with the European.

There is a sentiment in supply trade circles that cast-iron goods will advance before long, as a result of higher prices of pig iron. But the latter circumstance has not, to any extent, yet occurred. Doubtless it will in the near future.

IN THE POWER TRANSMITTING MACHINERY LINES

also, symptoms of improvement are to be found, although, as in other lines of supplies, not everywhere obvious. One company has had considerable to do, of late, in connection with rope transmission. A favorite application of this is in connecting the machinery of separate buildings. It is, of course, not much used on line shaft work. Another seller reports demand from silk mills and laundries.

In the matter of prices, the power transmitting machinery market shows room for improvement. Cold rolled steel shafting, as we have informed our readers, is weak. Babbitt metal is a little stronger.

The New York branch of a well-known wood pulley company handles also another line—wash-boards—in which, although it has not much to do with the machinists' supply market, there has this year been an activity worth alluding to as indicative of better times. Almost every month has been a banner one with them, for this class of goods, which they take to be a symptom of improved conditions among the working people. A peculiar feature, however, is that the present month in spite of the gain in surrounding business, shows a falling off.

A RANDOM REPORT ON MACHINE TOOLS.

J. E. Snyder, Worcester, Mass., manufacturer of upright drills, etc., remarks:

"Business is good, and the prospects are better for future trade than I have seen it for some time. I have sold more large tools the past month, than three months previous."

(Continued on page 36.)

(Continued from page 35.)

THE EXPORT FIELD.

The representative of a Western company manufacturing twist drills, reamers, chucks, etc., remarked that for a few days past his attention had been chiefly taken up with export orders. He spoke of Japan as a promising field, mentioned South America, and said that a good order had also been received from Germany.

A wood pulley company tell us that the principal topic of interst with them is the attempt to secure foreign trade. They do not find, however, that this year is altogether satisfactory, after the expectations that were kindled by the machinery trade of last.

A general machinery supply house who do a considerable business with Spanish America report that that trade is now just passably fair. They have received some stock orders for engines and boilers, but in Central America a tendency is at present noticeable to ask for long terms of credit—six or nine months.

PITTSBURG REPORT FOR AUGUST.

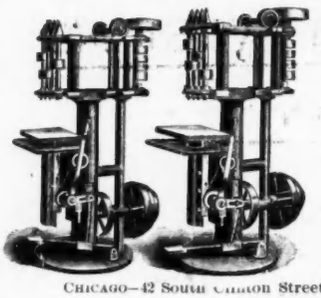
The surface conditions of trade present a better appearance than for months past; but in regard to those beneath the surface, or, in other words, to actual doings, no improvement outside of more inquiries, as compared with a month ago, is existing, as this month draws to a close. The whole thing may be summed up in the statement, that only fair business is being transacted, generally, and that prices have only advanced slightly. The main thing noticeable is that prices are trembling: there is not that steady advance and firm feeling that should characterize trade.

During the past week the Wrought-Iron Pipe Manufacturers' Association held a meting and moved up prices. In tubing, casing, pipe, etc., there has been an extremely good business prevailing, and an advance was agreed upon. In the crude iron lines, Bessemer has shown a little more improvement, and the outlook is promising. One of the main causes for the improved conditions in the raw-iron market is, that iron ore, which is now at low prices, is likely to be increased in cost by advanced lake-carrying rates. The coal strike is also having its effect upon the market, increasing the expense of iron production.

In the machinery lines there seems to be a lull in new work. It is remarkable what an amount of second-hand machinery has been installed in the numerous plants about here. Of late, users of machinery have been "held up" financially, and rather than expend more money and have first-class outfits, they look around for second-class material "in good condition."

What is said to be the finest and most complete steam plant in this section of the country, is that being installed in the Rankin mills of the Consolidated Steel and Wire Company. The engines, of the

(Continued on page 37.)



GANG DRILLS

of improved design, with two, three, four and six spindles in four sizes. The spindles are made of tool steel, have steel boxes hardened and ground, with provision for adjustment for wear. Tables are counterbalanced.

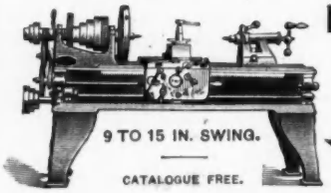
Vertical and adjustable Multi-Spindle Drilling Machines in 10 sizes, for bicycle hub, 20-inch; valve flange and intermediate work. Ask for the

"MACHINISTS" CATALOGUE.

THE PRATT & WHITNEY CO.,

HARTFORD, CONN., U.S.A.

NEW YORK—123 Liberty Street. BOSTON—281 Franklin Street.
CHICAGO—42 South Canal Street. LONDON, ENG.—Buck & Hickman, 280 Whitechapel Road.
PARIS, FRANCE—Fenwick Freres, 21 Rue Martel.



Lathes! Planers!! Shapers, &c.!!!

Our tools are all of the latest and most approved designs, while the workmanship, material and finish are of the highest order. You will find it an advantage to have our catalogue and special prices before placing your order.

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FOR FOUNDRYMEN

EACH,
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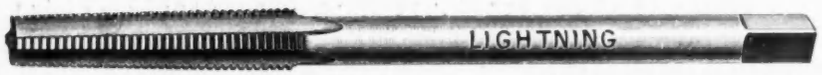
WEST. "American Foundry Practice."
WEST. "Moulders' Text Book."
BOLLAND. "Iron Founder."
BOLLAND. "Iron Founder, Supplement."

JOHN WILEY & SONS, 53 EAST TENTH STREET, NEW YORK.

FINE MACHINE RELIEVED TAPS.

"Lightning" and "Green River" Screw Plates, Dies, Tap Wrenches, Bolt Cutters and Drilling Machines for Hand and Power, Punching Presses, etc.—SEND FOR CATALOGUE.



WILEY & RUSSELL MFG. CO., GREENFIELD, MASS., U.S.A.

Agents in London, SELIG, SONNENTHAL & CO., 85 Queen Victoria Street

DYER & DRISCOLL,
PATENT SOLICITORS, 31 NASSAU STREET, N. Y.

Have done all my patent soliciting work, both for this and foreign countries, continuously for the past fourteen years.

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STAR LATHES

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Foot Power Screw Cutting, Automatic Cross Feed, 9 and 11" Swing.

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Seneca Falls Mfg. Co.
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WE CLAIM THE FOLLOWING MERITS FOR JENKINS BROS.' VALVES.

1. Manufactured of the best Steam Metal.
2. No regrinding, therefore not constantly wearing out the Seat of the Valves.
3. Contain JENKINS DISC, which is suitable for all Pressures of Steam, Oil and Acids.
4. The Easiest Repaired, and all parts Interchangeable.
5. Every Valve Tested before leaving the factory.
6. ALL GENUINE stamped with Trade Mark.

JENKINS BROTHERS, New York, Philadelphia, Chicago, Boston.

Die and Tool Steel.

NO BETTER MADE.

CRESCENT STEEL CO.

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THE BEST POWER HAMMERS ON EARTH.

22 sizes in Helve, Upright and Strap Styles.

Send for Printed Matter.

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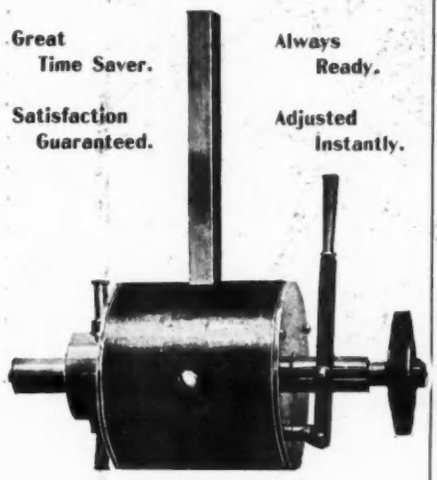

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CIRCULARS ON APPLICATION.

FINISHED CASTINGS
Shapes cast to exact size with holes, thread, etc.
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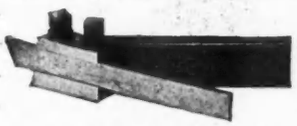
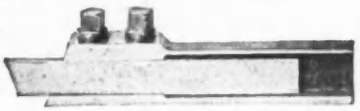
YOU OUGHT TO
Make some money with our Universal Hand Milling Machine. If you would express a desire to know how, the chances are greatly in your favor, that within a day or so you would receive the wherefore and why.
THE WHITNEY MFG. CO., Hartford, Conn., U.S.A.

MODEL WORK.
We are prepared to assist the trade and inventors in solving mechanical problems, also manufacturing models and stock
CENTURY MACHINE CO.
576 West Broadway, New York.
Complete outfit of Modern Machinery and Tools.

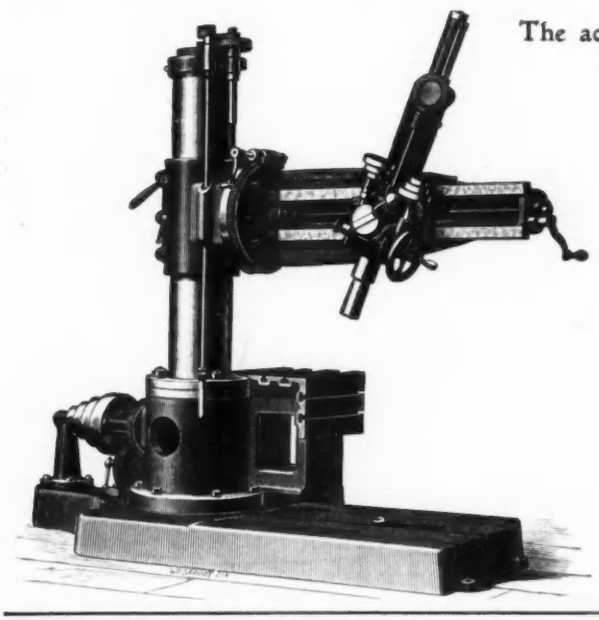


Cut off Expenses by using a "HUGH HILL" CUTTING-OFF TOOL.



A very rigid and durable tool. Made of drop forged steel, cutter held in place by two machine steel collar screws, and furnished with beveled self-hardening or tool steel cutter, ground narrower at the rear end to give clearance. The point of the blade is always the widest. Made in sizes to cut off shafts from ⅜-inch to 30 inches in diameter. The extreme large sizes have inserted cutters—made straight or bent, right or left. The tool has the advantage of cutting off close to the shoulder or chuck jaw, and the blades last a long time. It is a good tool to buy, because it will save you money, for there is no tool so hard to forge as a cutting-off tool. Tools sent on trial. Write for catalog.
THE HUGH HILL TOOL CO., Anderson, Ind.

BICKFORD DRILLS.



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Chas. Churchill & Co. Ltd.,
London and Birmingham.

(Continued from page 30.)

cross-compound condensing rolling-mill type, are being put in. The high-pressure cylinder is 32 inches in diameter, the low-pressure cylinder 58 inches, and the stroke 60 inches. At the most economical point of cut-off the engine will develop 2,000 horse-power, and at the latest point 4,000 horse-power, and be under perfect control of the governor all the time. Double eccentrics are provided for each cylinder for operating the valves which control the admission of the steam into the cylinders, independent of the valves which control the exhaust. The pumping plant will be furnished by Dean Bros.' Steam Pump Works, of Indianapolis, Ind.

Quotations.

NEW YORK, Monday, August 30.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$11 50 @ $12 00
No. 2 foundry, Northern	10 25 @ 11 00
No. 2 plain, Northern	10 00 @ 10 50
Gray forge, Northern	9 75 @ 10 00
No. 1 foundry, Southern	10 50 @ 10 75
No. 2 foundry, Southern	10 00 @ 10 25
No. 3 foundry, Southern	9 75 @ 10 00
No. 1 soft, Southern	10 50 @ 10 75
No. 2 soft, Southern	10 25 @ 10 50
Foundry forge, or No. 4, South'n	9 50 @ 9 75

Some Southern furnaces are asking 25 cents a ton advance.

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.00 @ 1.05c.; refined, 1.05 @ 1.15c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.30 @ 1.45c.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some grades perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.45 @ 1.50c.

Cold Rolled Steel Shafting—Base size, in store, in small lots, 2 @ 2¼c.

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Pig Lead—Carload lots, 4.15 @ 4.20c., f. o. b.

Pig Tin—For 5 and 10-ton lots, 13.75c., f. o. b.

Spelter—Carload lots, New York delivery, 4.30 @ 4.35c., f. o. b.

Antimony—The range, according to brand and quantity, is 7¼ @ 8c.

Lard Oil—Prime city, winter make, commercial quality, in wholesale lots, 40 @ 41c.

▲ ▲ ▲

Manufactures.

Chillicothe, O., is to have a sugar refinery costing $300,000.

Mr. A. Palm will erect a machine shop at Paso Robles, Cal.

The Chicago branch of the Standard Boiler Works, at Goshen, Ind., will be enlarged.

Marvin & Casler are soon to erect a large addition to their factory in Canastota, N. Y.

A three-story stone woolen mill will be erected at Willimantic, Conn., by E. A. Tracy.

The machine works and sawmill recently destroyed by fire at Spencerville, O., will be rebuilt.

The Conard & Jones Company are having a $1,000 addition built to their plant at West Grove, Pa.

The steel plant of the Colorado Fuel & Iron Company, at Denver, Col., will be enlarged and improved.

A large brewery will be built at Camden, N. J., by the New Jersey & Pennsylvania Brewing Company.

A large hominy mill north of Cayuga, Ind., was burned on the 19th ult. by a fire which originated in a hot-box.

The New England Furniture Company, of

FLATHER LATHES Are all they should be in design, workmanship and material.
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Westbrooke, Me., will erect a factory, 50 x 210 feet and two stories high.

Ralph Teeter, of Moravia, N. Y., has purchased the lot where McCreary's mill stood. He intends to rebuild the mill.

The plant of the Elk Rapids, Mich., Iron Company was destroyed by fire on the 17th ult., causing a loss of $15,000.

Fritz & Krause, of Royersford, will establish a branch hosiery mill at Pottstown, Pa. It will start in September, with fifty hands.

The Crowe Foundry & Machine Company, of Middlesborough, Ky., has been incorporated with $5,000 capital stock. William Crowe is chief incorporator.

A stock company is being formed at Coldwater, Mich., to manufacture a device for lowering coffins into the grave. The machine is controlled by the undertaker, and is noiseless.

George W. Beard, of Reading, Pa., will build a $50,000 car wheel works at Reading, Pa., for the Reading Car Wheel Company. It will be of brick, stone and steel. Cost about $60,000.

The Midvale (Pa.) Foundry Company is about to enlarge its plant. Plans have been prepared for a two-story pattern shop, 50 x 100 feet, and an extension to the present foundry, 68 x 109 feet.

Negotiations are pending between the firm of Young, Smyth, Field & Co., of Philadelphia, and the owners of the hosiery mill at Dover, Del., with the object of operating a shirt factory in Dover.

The Boston & Albany R. R. is building an addition to its car shops in Allston, Mass. This will be a machine shop to replace the shops in Boston, which will be torn down on account of the erection of the Southern depot.

The principal Treadwell mine of Douglass Island, Alaska, is soon to have the largest stamp mill in the world. It has been decided to double the capacity of the plant, making the number of stamps 300.

Workmen engaged in excavating for the foundations of the new building of the Seneca Falls, (N. Y.) Manufacturing Company, dug out two mill stones which were part of the equipment of a linseed oil mill which ran on that site fifty years ago.

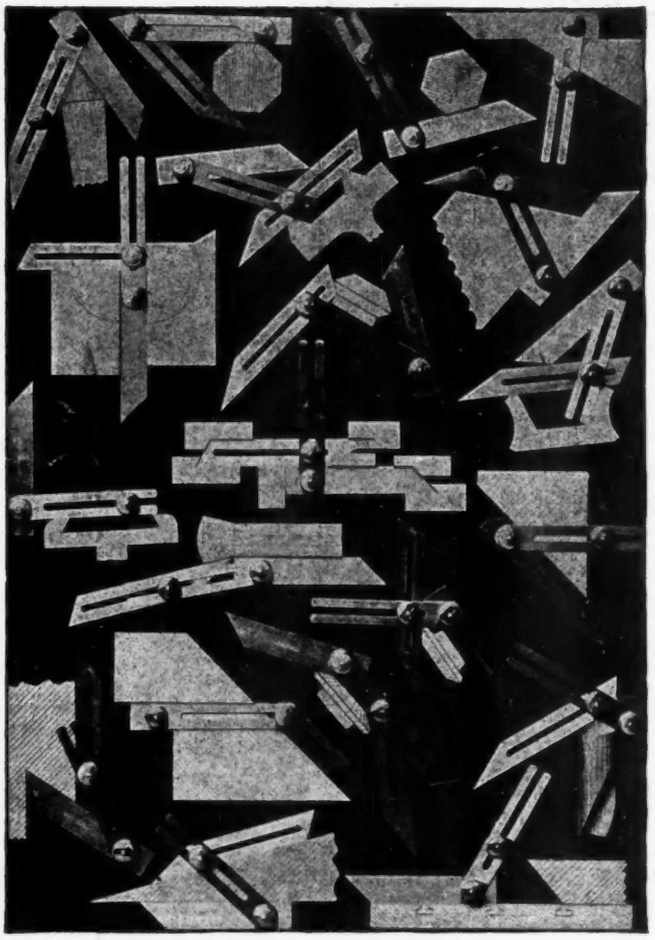
The name of the Cincinnati Rolling Mill Company has been changed to the Cincinnati Rolling Mill and Tin Plate Company. The plant is located near Riverside. The company has increased its capital and its facilities, and will begin the production of tin plate.

A new mill is to be built by the Corr Manufacturing Company on its property at East Taunton, Mass. It will be the same size as the one completed last year, and will give double the working capacity. This new enterprise means that an electric road to East Taunton may be built.

The Greenville (Pa.) Weldless Tube Company has announced that the plant will be enlarged, and an order for new machinery has been placed, consisting of engine, rolls and benches, for the manufacture of larger sized tubing than is being turned out at the plant at the present time.

Fire destroyed the 11-set woolen mill at Chepachet, R. I., known as the White Mill, and owned by the firm of H. C. White & Son, or H. C. White's heirs. The mill and machinery cost about $250,000, and their value before the fire was about 225,000, upon which there was a blanket policy of $100,000.

N. M. Fuhrman, receiver for the Columbiana (Ohio) Pump & Machine Company, concluded the deal which gives the Pittsburg Pump Company absolute ownership of the plant for a consideration of $8,000. They will enlarge the works, erect a large warehouse, and make it their principal shipping point.



Starrett's Combination Bevel No. 49

This tool consists of a stock, about four inches long, on which a split blade is hinged so as to swing over the stock and be clamped at any angle by a knurled nut; and a slotted auxiliary blade which may be slipped onto the split blade and, in combination with the stock, used for laying out work, measuring or showing any angle desired. The tool lies flat upon its work. The above engraving shows only a few of its almost numberless uses. Sent prepaid on receipt of price.

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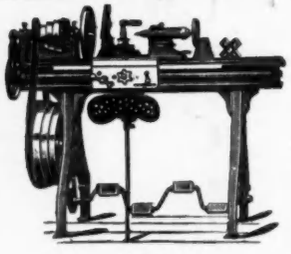

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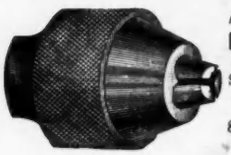
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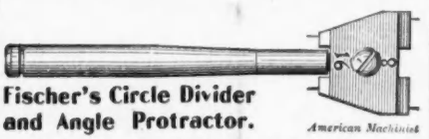
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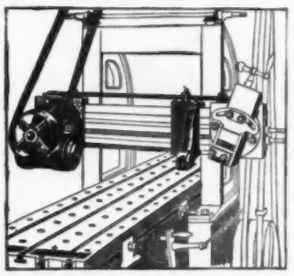

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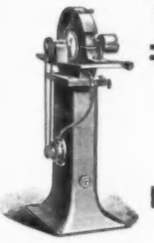

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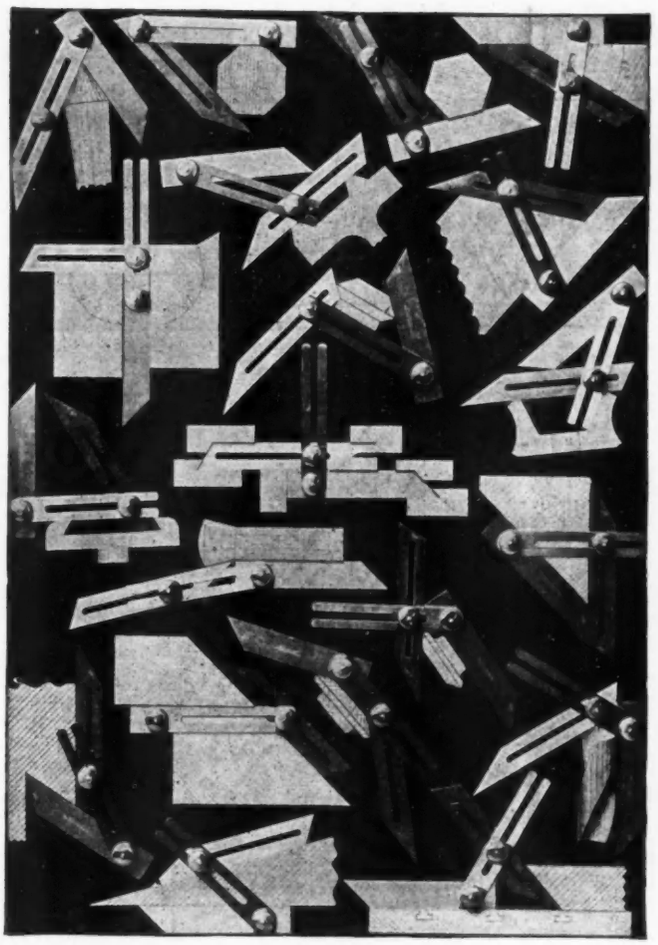

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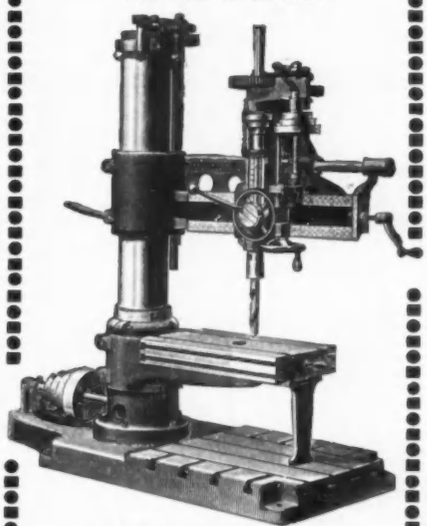

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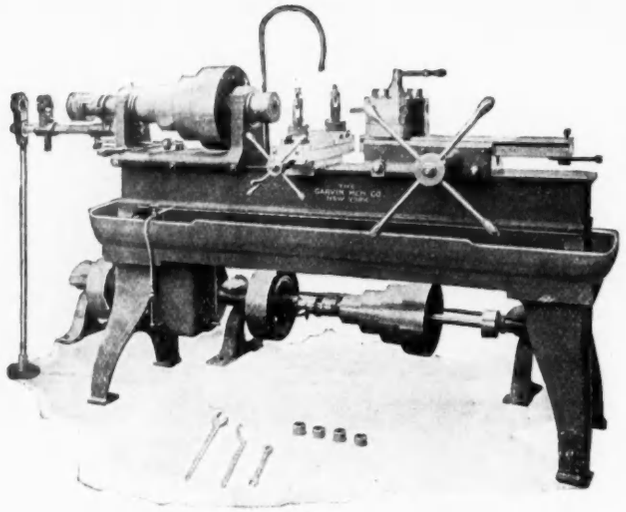

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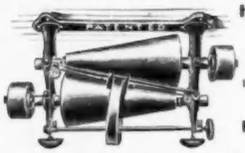

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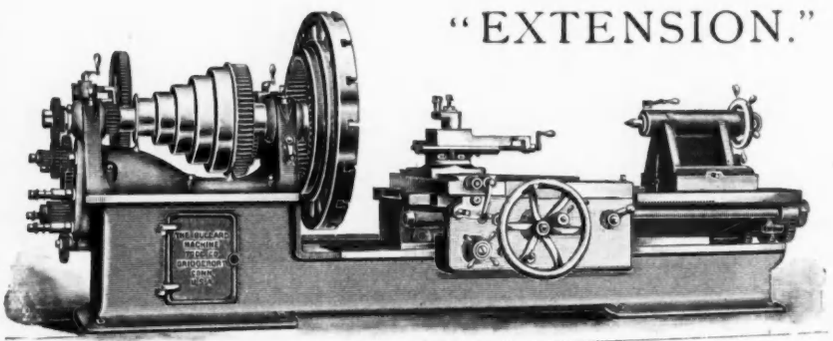

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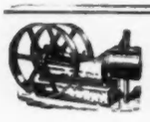

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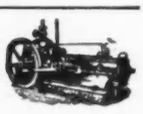

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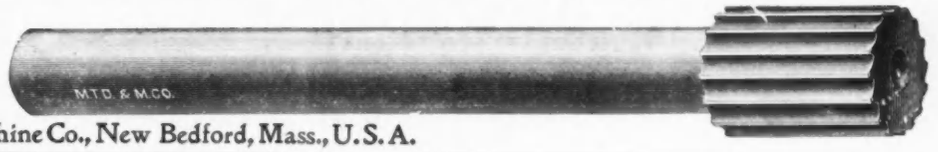

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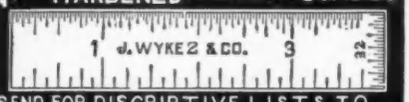

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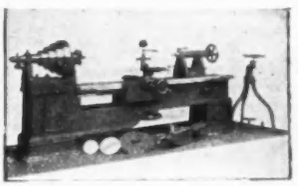

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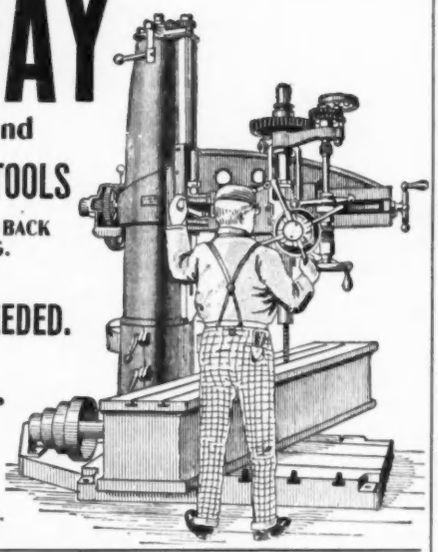

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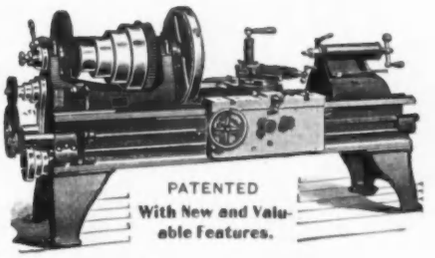

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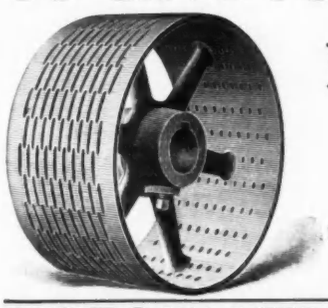

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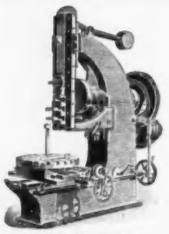

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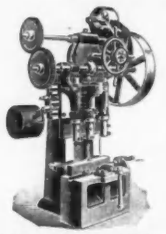

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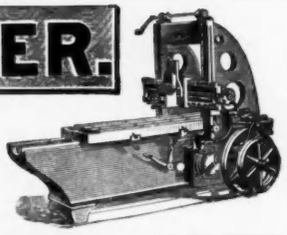

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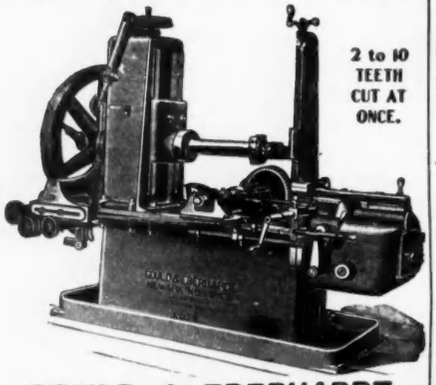

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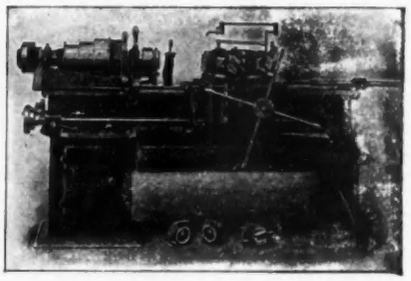

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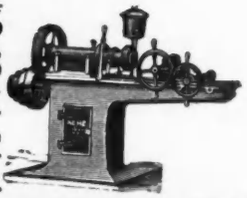

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